THE HEATING AND VENTILATING MAGAZINE

A MONTHLY JOURNAL OF HEATING PROGRESS

Vol. XV. No. 1
$1.00 a year. 10 cents a copy

JANUARY 1918

Published at Cooperstown, N. Y
New York Office. 1123 Broadway

GURNEY HEATERS

FOR HEATING ANY DESCRIPTION OF BUILDING BY STEAM OR HOT WATER

GURNEY HEATER MANUFACTURING CO.

NEW YORK OFFICE 11 E. 42ND ST. 188-200 FRANKLIN ST. BOSTON.

MASON REDUCING VALVES

and other PRESSURE REGULATORS

for all conditions of service

MASON REGULATOR CO., 15 Medway St Boston Mass.

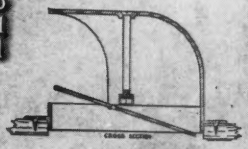
TRADE MARK MASON MASON

KNOWLES Air Hood Air Deflectors

For use under the aisle seats in all auditoriums

This device is designed to deliver the fresh air upward and out into the aisles and in one direction

The deflector is adjustable to any position and locked so that it cannot be disturbed



KNOWLES MUSHROOM VENTILATOR CO.

Telephone Cortlandt 7811 9 Church St. New York

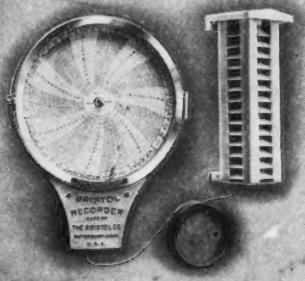
ATMOSPHERIC TEMPERATURES Accurately Recorded

Continuous records of outdoor temperatures guide the operation of heating and ventilating systems. The sensitive bulb of a

TRADE MARK BRISTOL'S REG. U.S. PAT. OFFICE

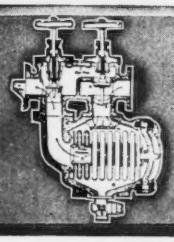
RECORDING THERMOMETER

Enclosed in a lattice box is installed out-of-doors and the recording instrument inside where it is readily referred to.



Write for Bulletin T-204

THE BRISTOL COMPANY Waterbury Conn.



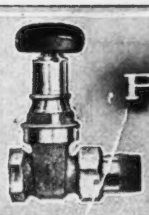
ROSS FEED-WATER FILTERS

Will Keep Oil Out of Your Boiler

Regulating Valves for Water, Steam, Air

Ross Valve Mfg. Co. Troy, N. Y.

Ask for List of Users



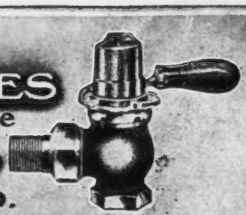
DOLE

PACKLESS RADIATOR VALVES

Insures Satisfaction — A Valve for every System — Write for Catalogue and Discounts

THE DOLE VALVE COMPANY

208 NORTH FIFTH AVENUE CHICAGO.



Entered as second-class matter at the Post-Office in Cooperstown, N. Y.

Copyright 1918, by Heating and Ventilating Magazine Co.

CLARAGE
KALAMAZOO

STEEL PLATE FANS

MULTIBLADE FANS

EXHAUSTERS

BLOWERS

ENGINES

HEATERS

DEPENDABILITY

is what counts every time. Clarage Fans may look like other fans, but appearances don't pretend to tell the whole story. The really big difference to you, and the only one worth considering, is what your fan will do and how long it will last.

And especially today, when the Nation is directing every effort, as never before, toward Bigger Production, you can't possibly afford to bother with quality that's doubtful.

There's too much at stake to risk the probability of time loss through repairs, and efficiency loss through faulty operation.

CLARAGE
KALAMAZOO

Fans and Blowers
GIVE REAL SATISFACTION

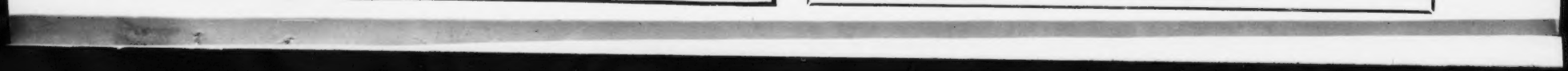
They can be depended upon to do the tasks cut out for them, and minus repair charges too.

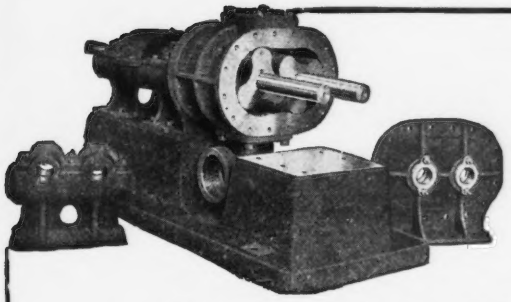
Write today for complete information—you will be interested in the Clarage Special Bearing—it saves Power Cost.

Our Engineering Department can be of assistance in planning your next installation.

CLARAGE FAN COMPANY.
KALAMAZOO—MICHIGAN—U. S. A.

NEW YORK CLEVELAND CHICAGO





Don't Make This Mistake

If you have made the mistake of installing a cheap, unsuccessful Rotary Pump, do not make the further mistake of concluding that all rotary pumps are worthless.

Instances of this kind have occasionally come to our notice and the "victim" is hard to convince that he would have had different results with the

Connersville Valveless Rotary Pump

This high grade Pump has been used for Vacuum Heating since 1908 in modern hotel, office, store, factory and other buildings in every state and city.

Ask for Bulletin 12H.

THE CONNERSVILLE BLOWER COMPANY
CONNERSVILLE, INDIANA

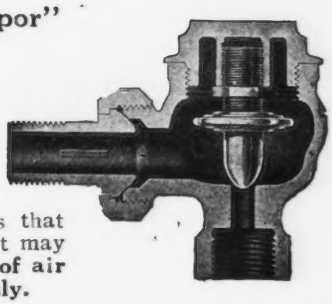
CHICAGO
929 Monadnock Block

NEW YORK
114 Liberty St.

Marsh Reflux Junior Thermostatic Traps

For Radiators and Coils of "Low Pressure," "Vapor" and "Vacuum Heating Systems"

Freely Discharges Air and Water Without Loss of Steam



THE Marsh REFLUX Return Line Trap is for use on the return end of radiators of low pressure, vapor and vacuum systems of heating. It is the result of a careful investigation into the actual requirements that must be fulfilled by a radiator return valve, in order that it may accomplish what is desired of it, namely, **to free the radiator of air and water without the loss of steam** and to do so **noiselessly.**

The Marsh Reflux Junior Thermostatic Trap is recommended for small radiators and coils. This Trap for the small and the Original Reflux for the large units will make an ideal job Especially adaptable for two pipe gravity work and vapor systems.

May be furnished either concealed adjustment (as illustrated) or with outside adjustment. **Write for literature fully describing this trap.**

JAS. P. MARSH & CO., 118-124 South Clinton Street **Chicago**

Established 1865

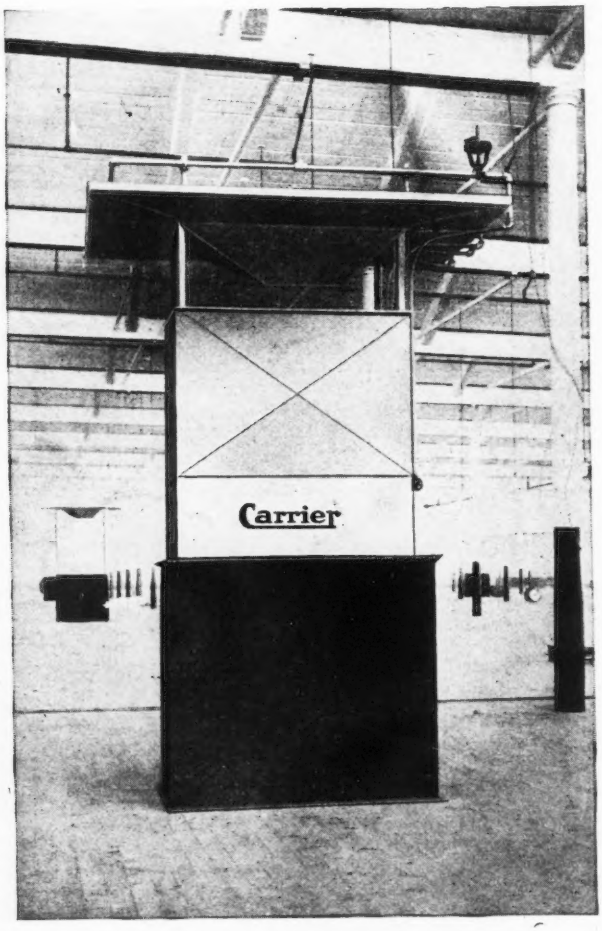
Manufacturers of Gauges for all Pressures and Purposes. **Automatic Air Valves and Steam Specialties.**

"Real Ventilation"

"No perceptible draft, but a sweeping of fresh, clean air through every part of the rooms all the time"—that is how one of our clients describes the effect of

CARRIER SYSTEM

Plenty of clean air, regulated as to temperature and humidity to exactly meet the requirements of workroom or any indoor space, offers a big stimulus to human activity.



At least, this has been found true where Carrier Air Conditioning Equipment has been installed in all classes of building, from J. P. Morgan's New York Bank house, the Hotel Astor, and the Royal Automobile Club, London, down to ordinary factory structures. Even more noticeable results have been observed in factories, mills, and shops where manufacturing processes render ordinary ventilation methods ineffective.

But the Carrier System is more than a ventilation system. It efficiently controls atmospheric conditions for humidifying, dehumidifying, heating, cooling, and drying.

Wherever quality or quantity of production demand a uniform cool or warm temperature, uniform low or high humidity, and thorough cleansing of the atmosphere from dust and dirt, Carrier Apparatus will pay big dividends upon its cost.

Tell us your needs and receive our literature and free advice.

CARRIER ENGINEERING CORPORATION

49 Cortlandt St., New York

BUFFALO	CHICAGO	BOSTON	PHILADELPHIA
Mutual Life Bldg.	Transportation Bldg.	176 Federal St.	Land Title Bldg.

72

"NATIONAL" Pipe and Nature's Rocks Both Evidence Durabiltty

Mr. N. C. Nicol, Met. Dept.,
National Tube Co.,
Pittsburgh, Pa.

Dear Sir:

In reply to your letter of the 3rd inst., I am sending you photograph of the atmospheric condenser which we have in operation here.

The condenser referred to was installed about five years ago, and is, as you are aware, made up entirely of "NATIONAL" pipe. It has been in operation constantly, night and day, under what I consider most severe corrosive conditions; as it is located on the roof, exposed to the weather with the cooling water constantly trickling over the entire outside of the pipe. During operation the cooling water is heated to a steaming temperature. I mention this, as it is a well known fact that water when heated to a high temperature is much more corrosive than when cold.

The name "NATIONAL" which was rolled on each length of pipe, stands out as clearly today as when the pipe was new. From this fact it is evident that the corrosion has been slight. Also we have not had trouble due to rust-scale forming on outside of pipe, and the only cleaning which we have done is to occasionally brush pipe on the outside with a broom.

As the pipe is subjected to both corrosive action on the outside, which I have mentioned, and also to the action of the condensed steam on the inside, and has withstood the test without any failures, I am glad to give you this letter for reference.

Yours very truly,
(Signed)————————(*)
Chief Engineer.

***Name and Address Supplied Interested Parties on Request.**

This Installation is in Western New York.

¶ Five years' steady service—365 days to the year—24 hours to the day—no rest—no let-up of any kind.

¶ SERVICE EVERY MINUTE.

¶ THAT was what "NATIONAL" Pipe was called on to do and at the end of five years, as mentioned in the chief engineer's letter, "The name 'NATIONAL' which was rolled on each length of pipe stands out as clearly today as when the pipe was new".

¶ Note also that the service was UNUSUALLY SEVERE.

¶ Again we say: "NATIONAL" Pipe and NATURE'S ROCKS both evidence durability.

¶To readily identify "NATIONAL" material and as protection to manufacturer and consumer alike, the practice of National Tube Company is to roll in raised letters of good size on each few feet of every length of welded pipe the name "NATIONAL" (except on the smaller butt-weld sizes, on which this is not mechanically feasible on these smaller butt-weld sizes the name "NATIONAL" appears on the metal tag attached to each bundle of pipe).

¶When writing specifications or ordering tubular goods, always specify "NATIONAL" pipe, and identify as indicated.

LOOK FOR THE MARK

NATIONAL

Name Rolled in Raised Letters on National Tube Company Pipe

¶In addition, all sizes of "NATIONAL" welded pipe four in. and under are subjected to a roll-knubbling process known as Spellerizing to lessen the tendency to corrosion, especially in the form of pitting. This Spellerizing process is peculiar to "NATIONAL" pipe, to which process National Tube Company has exclusive rights.

¶"NATIONAL" pipe was awarded the GRAND PRIZE (highest possible award) at Panama Pacific International Exposition, 1915.

NATIONAL TUBE COMPANY,

General Sales Offices:
Frick Building, Pittsburgh, Pa.

DISTRICT SALES OFFICES: Atlanta, Boston, Chicago, Denver, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, St. Paul, Salt Lake City

PACIFIC COAST REPRESENTATIVE: U. S. Steel Products Co.: San Francisco, Los Angeles, Portland, Seattle

EXPORT REPRESENTATIVES: U. S. Steel Products Co., New York City

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

BYERS PIPE

GENUINE WROUGHT IRON
FULL WEIGHT GUARANTEED

An Invitation

The Byers Company cordially invites architects, engineers, contractors, and others interested in pipe to visit their plants at any time when they may be in Pittsburgh.

This invitation is prompted by our desire most emphatically to prove that no steel or other foreign scrap is ever used in Byers Pipe, and that the methods employed for making the iron are the same as they were 50 years ago, with the added advantage of better control of raw materials and processes.

The most thorough microscopic examination of its structure reveals nothing but the true characteristics of old-fashioned iron. Chemical analysis confirms the same fact. Absence of crystalization, strength of weld, excellent threading quality, high rust resistance—all loudly proclaim by performance the fact that Byers pipe is ***iron,*** and ***iron only,*** of the best possible grade.

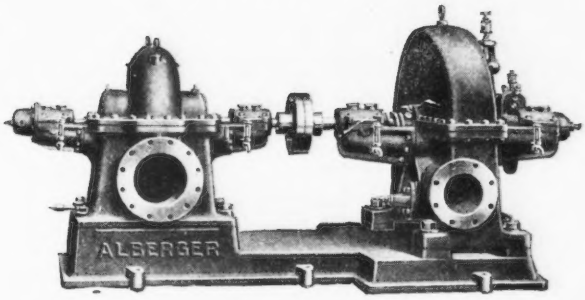
Byers mills are always open to the public—every part of them—and even in these war times nobody needs any special qualifications to gain admittance. The mills are conveniently located within five minutes ride of the business district, and an inspection trip can be accomplished in one hour, if that is all you can spare.

So be sure to Come

A. M. BYERS COMPANY
Established 1864
PITTSBURGH, PENNA.
New York Chicago Boston
Houston Los Angeles
Distributors in all jobbing centers
Ask for list of names

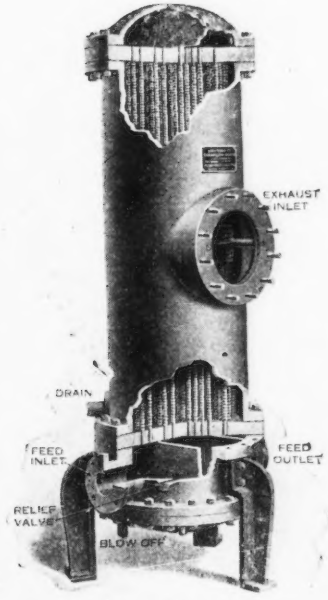
"ALBERGER"

Pumps Turbines Condensers



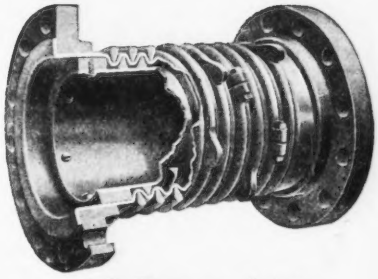
"WAINWRIGHT"

Closed Heaters Expansion Joints



Heaters in both Vertical and Horizontal Designs

Catalogs of any line will be sent on request to any of our Branch Offices



High Pressure Joints

Low Pressure Joints

ALBERGER PUMP AND CONDENSER CO.

140 CEDAR STREET, NEW YORK

Boston Chicago Pittsburgh St. Louis Philadelphia San Francisco

Nature and Wisdom

always say the same---

CAST IRON PIPE

Nature—because like a good mother she knows and protects her own. Witness the thin protective surface coating of rust which she bestows upon Cast Iron Pipe thus protecting it from actual deterioration.

Wisdom—because the world counts that man wise who profits by the experience of others. Witness the vast mileage of Cast Iron Pipe which serves mankind. A service measured not alone by miles but by centuries.

THE FIRST CAST IRON PIPE EVER MADE IN THE WORLDS HISTORY IS STILL IN SERVICE
SERVICE
CAST IRON PIPE
MEASURED BY
CAST IRON PIPE
CENTURIES
MORE THAN 250 YEARS OLD

The Cast Iron Pipe Publicity Bureau

1 Broadway, New York

As Reliable as the Expansive Forces of Nature

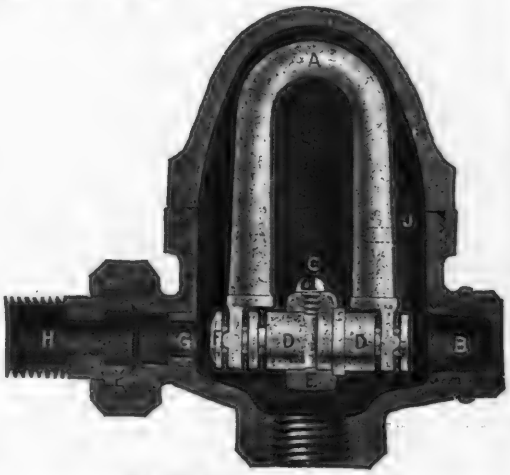
There is no guesswork about the action of the

Haines Vento Automatic Valves and Traps

Because they are all built with the thermostatic tube shown herewith

Guaranteed for 5 years and backed by 18 years of successful use

Let us send you catalogue explaining the principle of construction and operation of this valve. Free on request.



HAINES VENTO TRAP
Recommended for use with cast iron radiation with low pressure steam. Not exceeding 10 lbs.

WM. S. HAINES & CO., Philadelphia, Pa.

Get Things Done—Done Right

From the very time that you went to kindergarten, we venture to say that your teachers tried and never ceased trying to force upon you the fact that everything you did well was done, once and for all.

In your own business today, hardheaded, practical and experienced as you are, you very well know that the success of your heating contracts lie in your having everything done right.

Lavigne

Packless Quick-Opening Steam Radiator Valves

have been designed with a view of overcoming the weak points that exist in the ordinary style of valves and when used become a part of the **perfect system.**

Opens quickly and closes quickly. Positively will not leak air, steam or water.

Free from mechanical troubles.

BUILT RIGHT TO STAY TIGHT

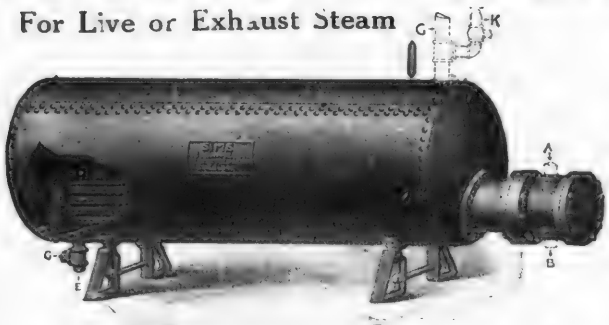
Ask your jobber for details

LAVIGNE MANUFACTURING COMPANY
Detroit, Michigan

Sims Clean E-Z Steam Tube Heater

For Hotels, Apartment Buildings, Hospitals, Y. M. C. A. Buildings, Schools, etc.

For Live or Exhaust Steam

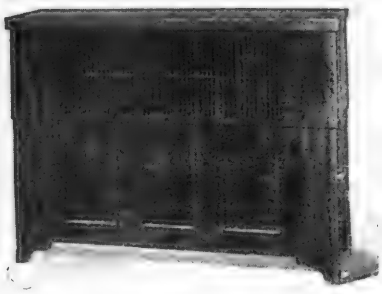


requiring large quantities of hot water. This type of heater should be used in preference to circulating generator and storage tank—or instantaneous heaters.

Special attention given to all kinds of water heating problems based on long experience in this work.

Valuable tables have been prepared, showing heater capacities using steam at various pressures. These tables are yours for the asking.

THE SIMS CO., 18th St., Erie, Pa.



HAVE YOU INVESTIGATED

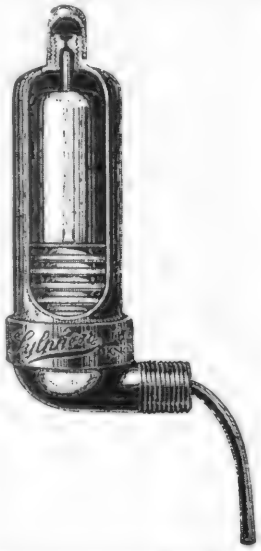
The Ja-Nar

(Sylphon Temperature Control)

This simple method of temperature regulation covers the radiator with a well-designed cabinet finished to match mahogany, oak, walnut or enamel, to correspond with its surroundings.

The Ja-Nar

It operates automatically on the well-known Sylphon principle of thermostatic control and requires no pipes, wires or connections of any kind. Just place it over the radiator. Each Ja-Nar operates independently. **Send for Catalogue "H".**

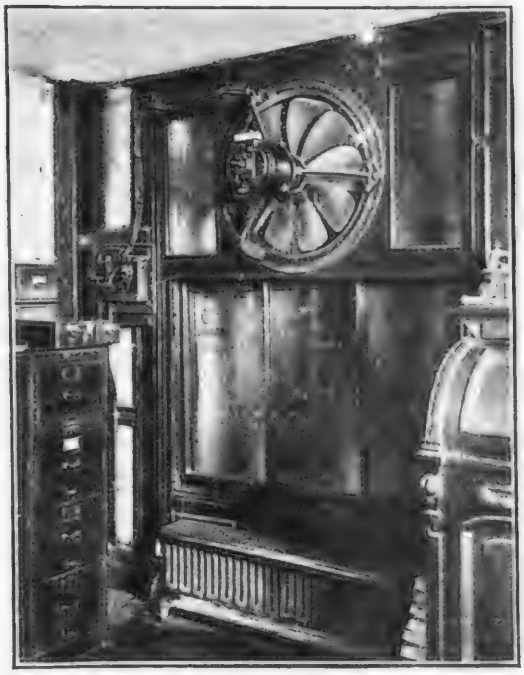


Really a Satisfactory Air Valve
No Adjustment Necessary
Thermostatic Operation
Absolutely Guaranteed

The *Sylphon* **AIR VALVE**

The Fulton Company

141 Broadway, New York **Knoxville, Tenn.**



Exhaust Fan Driven by Sprague Motor in an Office

Sprague Electric

Motors and Controllers

FOR

Ventilating Equipments

Alternating or Direct Current

Quiet in Operation
Uninterrupted Service
Minimum Attention

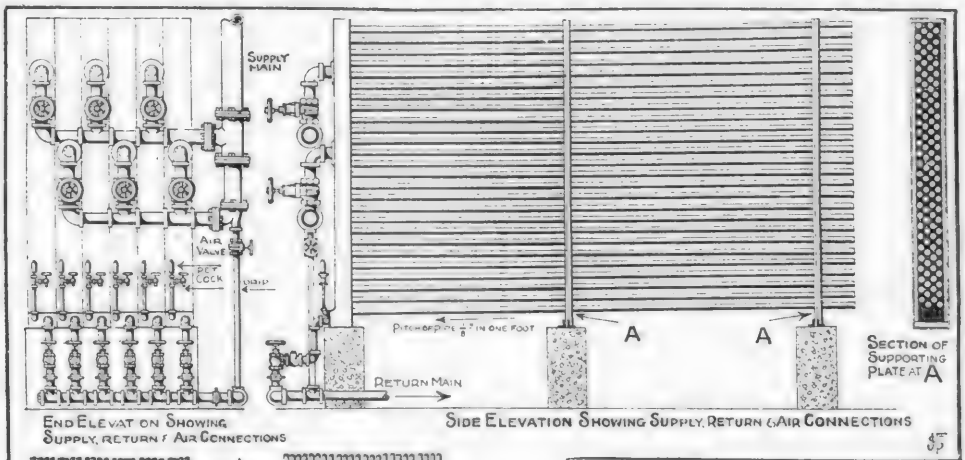
Complete Outfits Furnished

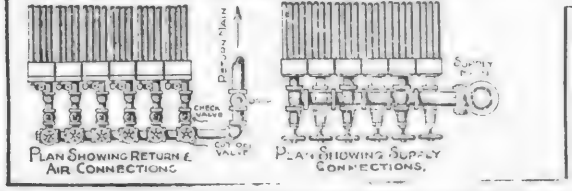
Write for Bulletin No. 41801

SPRAGUE ELECTRIC WORKS
OF GENERAL ELECTRIC COMPANY
MAIN OFFICES:
527-531 W. 34th St., New York, N. Y.
Branch Offices in Principal Cities

CHINOOK HEATERS

Give Positive Circulation. No Unequal Expansion and Contraction. Highly Efficient.



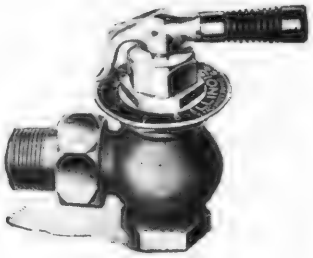


Gravity Return Connections
Horizontal Type Heating Coils

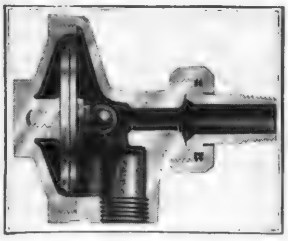
BAYLEY MFG. CO.
Milwaukee, Wis.

ILLINOIS ENGINEERING COMPANY

Chicago, Ill.



Fine Vacuum Heating Material



Some Typical Installations are:

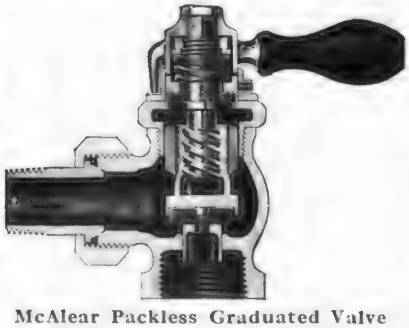
LORD & TAYLOR CO.	New York
BLACKSTONE HOTEL	Chicago
BLACKSTONE HOTEL	Omaha
OLYMPIC CLUB	San Francisco
TITLE INSURANCE BLDG.	Los Angeles

Perfect Circulation Control and Distribution

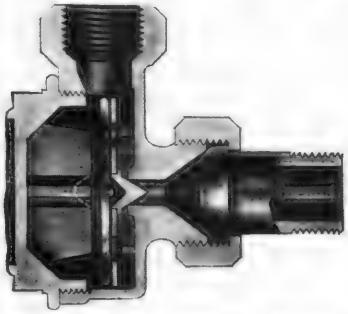
of steam is obtained with the

McALEAR

Vacuum and Vapor Heating Specialties



McAlear Packless Graduated Valve



McAlear Perfection Radiator Trap will close tight against a steam pressure of 50 lbs., when discharging direct to the atmosphere, or into a vacuum of from 1 in. to 25 in.

The McAlear System is preferred for office buildings, hotels, schools, public buildings of various types and hospitals, where absolute quietness is necessary. The McAlear System works perfectly with or without temperature regulation, or on a one or two pipe system.

Send for our manual on "The McAlear System" It is a general reference book on heating

McALEAR MFG. CO.,
223 West Erie St., Chicago, Ill.

The Heating and Ventilating Magazine

VOL. XV. NO. 1

Contents for January, 1918

Utilizing the Heat in a Pound of Coal . . . . . *Harold L. Alt* 15
An Analysis of the Relation Between Heating and Mechanical Equipment from a Fuel Standpoint.

How Much Do You Pay for the Water in Coal? . . *W. F. Schaphorst* 19

Chicago Commission on Ventilation . . . . *Edited by Samuel R. Lewis* 20
Ventilation Test of the Lewis-Champlin School, Chicago, Ill.

How To Use a Psychrometric Chart . . . . . *J. I. Lyle* 33
Ten Typical Examples and Their Solution Based on the Carrier Psychrometric Chart.

A Notable Heating and Ventilating Index 36

Recent Development of the Baldwin Air Cooling, Drying and Purifying Apparatus . . . . . *W. J. Baldwin* 44

Power Plant Engineering 47
Measuring the Feed Water.

Correspondence 50
Hot Water Heating Connection to Garage.
Formulas for Figuring Pipe Capacities.

The War and the Heating Engineer 52
Lower Indoor Temperatures as a War Conservation Measure.
Store Saving in Fuel.
The Watchman Evil.
Paying for Liberty Bonds.
Growth of Federal Reserve System.
The Responsibility of Science for War Horrors.
Engineers Serving Government in War.
Preparation for Third Liberty Loan.
Organization of Central War Industries Committee.
New Food-Saving Suggestions.
War-Saving Certificates.
Old Tracings for Bandages.
Heating Men in Military Service.

New York Steam Company's Rates Reviewed by Public Service Commission 56

How the Contractors Saved the Day at Camp Upton 62

Current Heating and Ventilating Literature 63

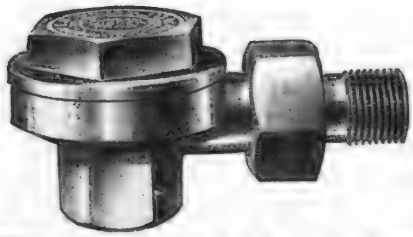
New Form of Ductometer 64

Standard Heating and Ventilating Data Sheets 67
No. 13—Radiation—Computing.
No. 13-A—Radiation Efficiencies.
No. 13-C—Radiation, Computing—Example.
No. 14-A—Radiators—American One-Column Rococo.

YEARLY SUBSCRIPTION $1.00 **SINGLE COPIES, 10 CENTS**

Published monthly at Cooperstown, N. Y., by the Heating and Ventilating Magazine Co.

Executive and Editorial Offices, 1123 Broadway, New York



The DUNHAM

Radiator Trap

Does Its Bit in Saving Coal

The Dunham Radiator Trap actually *saves* coal at the point where it is most frequently *wasted*—at the outlet of the radiator. Knocking, pounding and hissing is the result of air and water trying to escape. Every time that annoying noise is heard valuable heat units are being wasted—absolutely thrown away. The Dunham Radiator Trap overcomes this difficulty. It saves coal.

Heating Contractors Can Help the United States Government

Not a Ton of Coal Must be Wasted

The Nation's Resources Must be Conserved

Use the Dunham Trap on new installations—install it as an economy—a coal saver—on existing heating plants. Factory or residence.

Write for Bulletin

C. A. Dunham Company

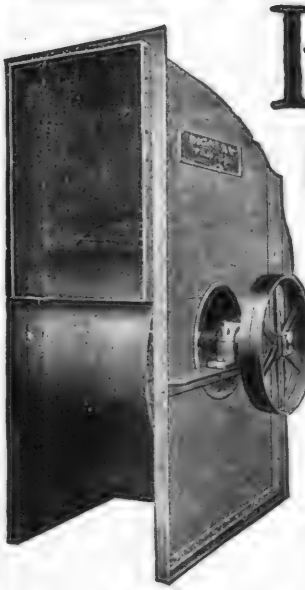
Fisher Building, Chicago, Ill.

FACTORY—MARSHALLTOWN, IOWA

Canadian Factory—Toronto

Branches in principal cities within the United States and Canada

BICALKY

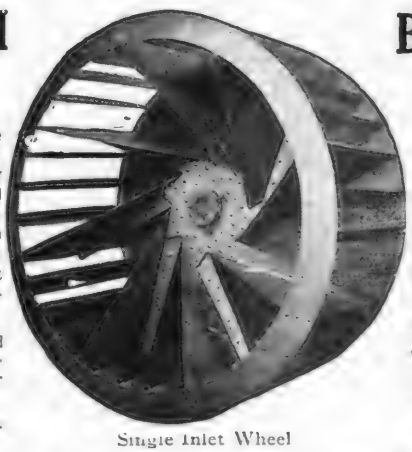


BI-MULTI FANS

are used all over the country and abroad. They are specified by leading engineers and architects. Their design and construction permit operating these fans at the highest pressure without racking.

The efficiency obtained with these fans has upset all previous engineering dope.

We guarantee results. Write for Catalogue.



Single Inlet Wheel

BI-MULTI FAN WHEELS

are built exceptionally strong. They are guaranteed to stand up and do not rack under the heaviest work that fans are subjected to

This, in connection with their high efficiency, has created the large demand for

BI-MULTI FANS

BICALKY FAN COMPANY **Buffalo, N. Y.**

SALES AGENTS

Batterman, Truitt Co., 18-20 East Kinzie St., Chicago, Ill.
J. S. Chapman & Co., 89 Jarvis St., Toronto, Ont.
Schellhammer & Co., Warren Pa.
Chas. W. Carll's Sons, 3-7 West Front St., Trenton N. J
Sink & Edwards, 519 Massachusetts Ave., Indianapolis, Ind.
Eagle Roofing & Art Metal Works, 203 Cass St., Tampa, Fla.

THE HEATING AND VENTILATING MAGAZINE

Cooperstown, N. Y. JANUARY, 1918 1123 Broadway, New York

Utilizing the Heat in a Pound of Coal

An Analysis of the Relation between Heating and Mechanical Equipment from a Fuel Standpoint.

By HAROLD L. ALT

The time has come when heating and ventilating must be considered on a broader basis and more in its relation to the other equipment in a building with which it must be associated. To carry out the nation-wide movement for conservation and economy it is necessary to produce the maximum amount of service out of a pound of coal and, while this object has always been the goal of all good engineers, it is doubtful if some of the specialists have taken into consideration the service performed, or which can be performed by a pound of coal outside the limitations of their concentrated activities.

How much and what can a pound of coal be made to do and is it being utilized to its full extent in existing and proposed installations? To consider this question intelligently it is necessary to review the cycle through which heat—formed by the combustion of fuel—passes in the process of utilizing its liberated energy to the utmost practical limit.

In the first place the pound of coal is thrown into the boiler furnace and is there burned, delivering—if proper conditions of combustion are provided—all of its energy in the form of heat. Part of this heat is radiated into the ash pit and the surrounding atmosphere, part is used in raising the fresh cold air supply up to the temperature of the gases of combustion, and part passes off and up the stack there producing all or part of the required draft; the larger portion, however, is absorbed into the water in the boiler and evaporates a certain quantity of the water into steam.

The steam then leaves the boiler and if it is to be used most effectively this steam will be generated at high pressure and will not enter the heating system direct, but, instead, will be utilized for some power-producing apparatus, such as an engine, pump, turbine, etc. After leaving such devices the exhaust, while having lost its high pressure, still possesses much of its original heat energy and may be turned into a heating system and the remaining heat utilized. In fact, some of the oldest engineers whose experience has been the largest, claim that the same building can be heated to the

same degree with a fewer number of pounds of exhaust steam than with live steam. If this contention is true then the utilization of steam for power purposes is an actual heating economy exclusive of the gain made on the power end.

But, while the exhaust may be condensed and used in the heating system during the winter, this does not provide for a profitable employment of the same exhaust during the summer months and this has always been somewhat of a deterring factor when the proposal to use steam units throughout an installation has been considered. Modern progress, however, has now come to the rescue and for the summer months has evolved a most essential and desirable use for this surplus in the shape of exhaust steam refrigeration by the absorption system.

In this system the ammonia is driven out of the aqua ammonia contained in the ammonia boiler by interior coils into which the exhaust steam is admitted. The ammonia vaporizes, due to the heat of the steam, and generates a very high pressure; under these conditions it is cooled and condensed in a condenser after which it is ready for use in cooling coils either of the direct-expansion type or through a brine-circulating system.

PERCENTAGE OF HEAT USED IN REFRIGERATING SYSTEM.

But what are the proportions existing in such an installation and what percentage of the energy of the pound of coal finally reaches the refrigerating system and makes its appearance in the shape of a solid cake of ice?

In reference to this the graphic chart shown in Fig. 1 is particularly interesting. Here a per cent scale at the top indicates the percentage of total heat in the coal while the black lines indicate graphically the percentage of heat at various stages by their length; the hollow extensions on the black lines indicate the amount of loss occurring in the step listed at the left.

Thus, the first line at the top indicates the heat produced by the combustion of the coal, this being taken as 100%; the next line indicates the amount of heat left after the stack loss of 21% (indicated by the hollow extension on the right) is deducted; the next line indicates the amount of heat left after deducting the 7% ash pit and radiation losses, this being the amount of heat delivered into the water and going to form steam. After this is indicated a 2% loss occurring in the piping between the boiler and the apparatus in which the steam is used for power; the next line indicates the amount of heat so delivered, or about 70%, and the next the amount used or about 10%; after this is shown the amount of heat in the exhaust or about 60%, all of which formerly must have been entirely wasted during the summer months. In the winter this could have been utilized at 100%

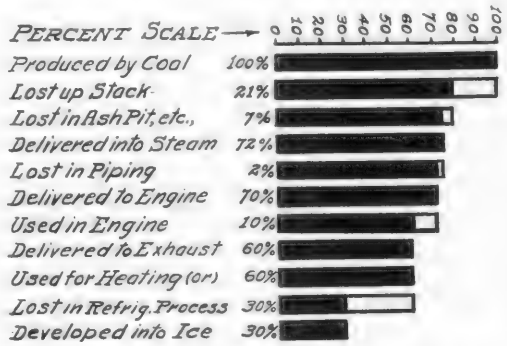

PERCENT SCALE →
0 10 20 30 40 50 60 70 80 90 100
Produced by Coal 100%
Lost up Stack 21%
Lost in Ash Pit, etc., 7%
Delivered into Steam 72%
Lost in Piping 2%
Delivered to Engine 70%
Used in Engine 10%
Delivered to Exhaust 60%
Used for Heating (or) 60%
Lost in Refrig. Process 30%
Developed into Ice 30%

FIG. 1—PERCENTAGE OF HEAT USED IN REFRIGERATING SYSTEM.

efficiency for heating, but unless absorption refrigeration is resorted to in the summer 60% of the pound of coal will have to be wasted during the summer months which is half the time or an average of 30% for the entire year.

There is considerable loss in the refrigeration equipment due to absorption of heat during the hot weather so that only about 50% efficiency of the apparatus is obtainable, but even at 50% the 60% of the heat in the pound of coal will give a utilization of 30% which appears in the form of ice, or about 33%, if refrigeration without ice is used.

GRAPHIC CHART BASED ON AVERAGES ONLY

On the chart only average percentages obtained under normal operating conditions are shown and probably no single plant would follow these percentages all the way through, although it might approximate them. The fallacy of expecting exactness in such a general statement can be seen from the fact of the great variation in steam consumed per I. H. P. of various types of standard engines and pumps on the market today.

For instance—one engine will require per I. H. P. hour on

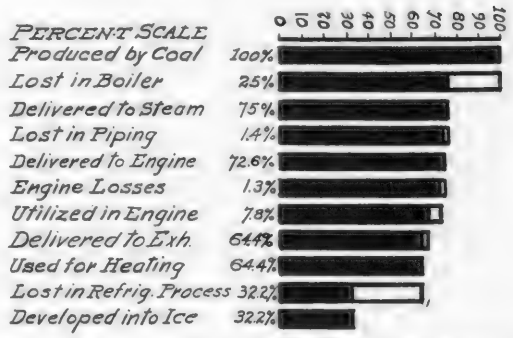

PERCENT SCALE
0 10 20 30 40 50 60 70 80 90 100
Produced by Coal 100%
Lost in Boiler 25%
Delivered to Steam 75%
Lost in Piping 1.4%
Delivered to Engine 72.6%
Engine Losses 1.3%
Utilized in Engine 7.8%
Delivered to Exh. 64.4%
Used for Heating 64.4%
Lost in Refrig. Process 32.2%
Developed into Ice 32.2%

FIG. 2—HEAT LOSSES AND UTILIZATIONS FOR A SINGLE-CYLINDER ENGINE.

Triple expansion engines	11 to	14	lbs. of steam
Compound engines	12 to	15	" " "
Simple, condensing engines	17 to	20	" " "
Simple, non-condensing jacketed engines	18 to	22	" " "
Simple, non-condensing unjacketed engines	24 to	35	" " "
Piston and plunger pumps	60 to	200	" " "

The graphic chart therefore is based on averages only and must not be too closely criticised. It gives a good idea, however, of the heat efficiencies and losses of the pound of coal.

For example—a certain engine requires 20 lbs. of steam per horsepower at 70 lbs. gauge and, if the mechanical equivalent of heat is 2545 B. T. U., per horse-power, then it is very easy to compute the heat efficiency of the engine, since each pound of steam at 70 lbs. gauge contains 1116 B. T. U. Then the input is 1116 B. T. U. $\times$ 20 and the developed I. H. P. or 2545 B. T. U. and $2545/1116 \times 20 = 11.4\%$ used in the engine. At 30 lbs. per I. H. P. 7.6% would be used and at 15 lbs. 15%.

All of which leads to the point where the uselessness is perceived of trying to establish any practical relation between the boiler and engine horsepower. Of course there *is* a theoretical relation since both may be reduced to B. T. U. If the quantity, pressure and temperature of the steam entering an engine is measured and the temperature, pressure and quantity of the exhaust is noted it is self-evident that both can be reduced to B. T. U. and the difference between be assigned as engine losses and as utilized in the production of work. But there is no connection between this and a boiler horsepower.

According to the accepted definition of a boiler horsepower it consists of the evaporation of 30 lbs. of water from a temperature of 100° F. into steam at 70 lbs. gauge or the equivalent of evaporating 34½ lbs. of water from and at 212° F. into steam at atmospheric pressure. This requires

$34.5 \times 970.4 = 33{,}479$ B. T. U.

Someone recently discovered that this was a trifle over thirteen times as much as an engine horsepower by the following reasoning:

1 foot pound = 778 B. T. U.
1 engine H. P. = 33,000 ft. lbs. per min.
1 engine H. P. hour = $33{,}000 \times 60 =$ 1,980,000 ft. lbs.
$1{,}980{,}000/778 = 2{,}545$ B. T. U. per engine horsepower.
$33{,}479/2545 = 13.1 +$

This relation is authentic but of little use.

It is much more essential to know the

distribution of the B. T. U. in a pound of coal, these being divided up about as follows, assuming 14,000 B. T. U. per pound of coal burned.

(a) B.T.U. developed in burning 1 lb. of coal	14,000	×	100%	= 14,000
(b) B.T.U. lost up stack	14,000	×	21%	= 2,940
(c) B.T.U. lost in ash-pit and radiated	14,000	×	7%	= 980
(d) B.T.U. lost in piping	14,000	×	2%	= 280
(e) B.T.U. used in engine	14,000	×	10%	= 1,400
(f) B.T.U. left in exhaust	14,000	×	60%	= 8,400
(g) B.T.U. utilized in heating system (or)	14,000	×	60%	= 8,400
(gg) B.T.U. lost in refrigeration plant	14,000	×	30%	= 4,200
(gg) B.T.U. incorporated into ice	14,000	×	30%	= 4,200

From this it can readily be seen how many B. T. U. per pound of fuel are available at any point and how many can be utilized under common operating conditions.

ADVANTAGE OF RUNNING BOILERS ABOVE RATED CAPACITY

It is well known that a boiler operated under high pressure will produce steam to a large extent depending upon the grate area and intensity of draft rather than on the heating surface. In fact many corporations make it a regular practice to run their boilers at 100% overload or 200% rating. On this basis a nominal boiler horsepower may produce anywhere from 30 to 60 lbs. of steam per hour according to the degree of overload and an engine may consume anywhere from 11 to 35 lbs. of steam per engine horsepower. The uselessness of trying to establish a practical relation between two such variables is apparent and the old catalogue phrase that "one boiler-horsepower equals two engine horsepower" should be forgotten once and for all.

HEAT PERCENTAGE CHART FOR VARIOUS TYPES OF PRIME MOVERS

The distribution of the B. T. U. in a pound of coal is even more interesting when considered for special cases. For instance the heat losses and utilizations for a single-cylinder engine in which the exhaust is utilized for heating are shown in Fig. 2. In this graphic analysis 25% of the B. T. U. is lost in the boiler, 1.4% in the piping to the engine, 1.3% loss in the engine and 7.8% utilized for work, with 64.4% left for heating or refrigeration work.

In Fig. 3 is shown the results obtained from a steam turbine where the total B.T.U. generated loses 25% in the boiler, 1.37% in the piping to the turbine, 0.53% radiation from the turbine, has

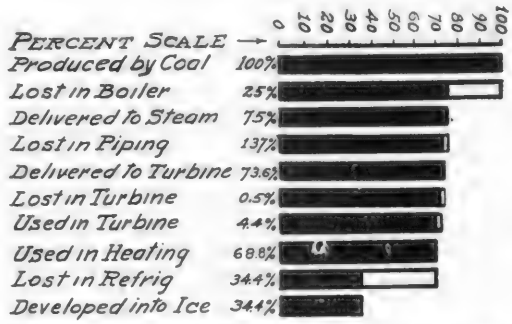

0 10 20 30 40 50 60 70 80 90 100
PERCENT SCALE →
Produced by Coal 100%
Lost in Boiler 25%
Delivered to Steam 75%
Lost in Piping 1.37%
Delivered to Turbine 73.6%
Lost in Turbine 0.5%
Used in Turbine 4.4%
Used in Heating 68.8%
Lost in Refrig 34.4%
Developed into Ice 34.4%

FIG. 3—RESULTS OBTAINED FROM A STEAM TURBINE.

4.38% transformed into work, leaving 68.72% for heating or refrigeration.

In Fig. 4 is shown the result from a tandem compound engine, run condensing. Here it is seen that the boiler loss is 25%, piping 1.3%, condensation in engine 2.5% transformed into work 11.8%. The balance is carried off in the condensing water, leaving no exhaust for heating or other uses, this resulting in a dead loss of 59.4%. Thus the most efficient engine is not by any means the most economical when considered from the pound of coal standpont for to supply a heating system with this engine there must be used a heating plant, or else additional high-pressure steam must be taken from the boilers

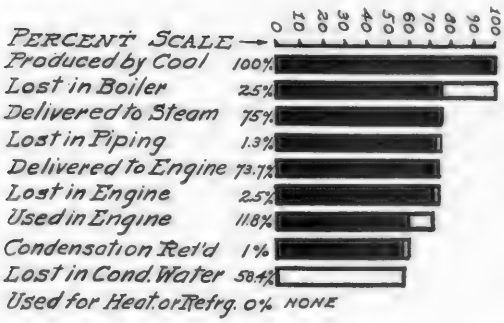

PERCENT SCALE →
0 10 20 30 40 50 60 70 80 90 100
Produced by Coal 100%
Lost in Boiler 25%
Delivered to Steam 75%
Lost in Piping 1.3%
Delivered to Engine 73.7%
Lost in Engine 2.5%
Used in Engine 11.8%
Condensation Ret'd 1%
Lost in Cond. Water 58.4%
Used for Heat or Refrg. 0% NONE

FIG. 4—RESULT FROM TANDEM COMPOUND ENGINE, RUN CONDENSING.

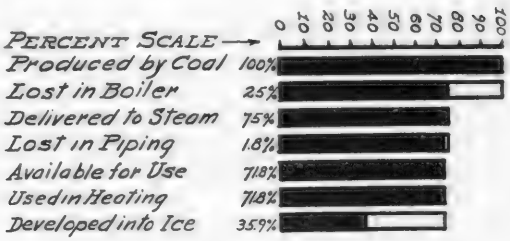

PERCENT SCALE →
0 10 20 30 40 50 60 70 80 90 100
Produced by Coal 100%
Lost in Boiler 25%
Delivered to Steam 75%
Lost in Piping 1.8%
Available for Use 71.8%
Used in Heating 71.8%
Developed into Ice 35.9%

FIG. 5—DIAGRAM FOR HEATING PLANT.

and injected into the heating system through a reducing valve.

The diagram for the heating plant is shown in Fig. 5. Here of the 100% developed 25% is lost in the boiler and 75% is delivered into the steam for heating or refrigeration use. If, in Fig. 4, the exhaust had been utilized, instead of being condensed, 59% of every pound of coal burned under the power boilers for power would have been available for heating or refrigeration use.

How Much Do You Pay for the Water on Coal?

By W. F. Schaphorst.

It is a common practice for coal dealers to "wet down" the coal they sell for the purpose of laying the dust. Water, however, is rather "heavy stuff." It takes but 32 cu. ft. of it to make a ton. At the present high cost of coal and its trend upward, the cost of water is, therefore, going up also.

How much water will cling to coal is, of course, uncertain. 10 lbs. might be the limit with smooth, hard, large-lump anthracite. Anthracite, however, does not need wetting as much as bituminous and the softer coals. Fine soft coal will doubtless absorb 100 lbs. of water per ton. Coal dust will, perhaps, absorb its own weight in water.

For example, let us assume that after being wetted down, a ton of coal, as sold, is actually 1,900 lbs. coal and 100 lbs. water and that the dealer's price is $4.00 per ton. What is the actual price per ton?

The method of computing this can be put in the form of a formula:

$$\frac{2{,}000}{2{,}000 - W} \times P = A$$

where A is the actual price per ton

W, the weight of water per 2,000 lbs.

P, dealer's price per ton.

Substitute in this formula and you will find the actual price in the above problem to be $4.21 per ton.

That, however, is not all. There is another loss, the cost of evaporating the 100 lbs. of water in the furnace. Although not so great, it is a loss that is worth considering, where much coal is purchased. In direct contact with the flames, with no intermediate iron shell to diminish efficiency, a pound of coal should evaporate at least 10 lbs. of water. Ten pounds of coal would, therefore, be required to evaporate the above 100 lbs. of water, which leaves but 1,890 lbs. of "effective coal" per 2,000 lbs.

Substituting in the above formula we get $4.23 as the actual cost per ton. Considering this loss, in addition to the first loss, the formula becomes:

$$\frac{2{,}000}{2{,}000 - 1.1\ W} \times P = A$$

Although 23 cents per ton may not sound like much, it is easy to see that when selling 100 tons per day the coal dealer can easily make $23.00 on "watered stock."

CHICAGO COMMISSION ON VENTILATION

Ventilation Test of the Lewis-Champlin School

II

Edited by SAMUEL R. LEWIS.

(Continued from December Issue)

Room No. 104.

MARCH 8, 1917

1. The amount of air delivered for each occupant was 42 cu. ft. per minute. 310 cu. ft. per minute were leaving the room at other points than at the exhaust. This is characteristic of a plenum system for a room on the leeward side. The location of supply and exhaust openings with reference to each other and the exposed surfaces, is supposedly fortunate, since both are on an interior wall, opposite the cold exposure. All of the operating conditions were presumably normal. The fan was running at slightly above the calculated speed. The distribution was fair, as evidenced by the CO_2

LEWIS-CHAMPLIN - GRAMMAR SCHOOL — MARCH 8, 1917

ROOM 104 - VOLUME = 12,240 CU FT. - SUPPLY REG. 72"x19" 95% EXHAUST REG. 25"x20" 35% — L.C. 16

Time	Occupants	Air Space per Occupant	Supply Vel ft per M	Supply Vol C.F.M.	Exhaust Vel ft per M	Exhaust Vol C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel Hum %	Air Motion ft per M	Dust Particles Per Cu Ft	Bacteria 2 Min Plate	Odors % Free from	CO_2	Weather Conditions Temp	RH	Wind Dir	Wind Vel
10:30	35 Pupils 1 Teacher	340	162	1540	352	1230	1	69	53	33		40,000	6		5.7 8.0	34	75	W	24
to							2	70	54	33		"	7		6.9				
11:30							3	69	52	29		"	3		5.7 5.7				
A.M.							4	70	53	30		"	7		7.7 7.1				
							5					25,000			4.0				
							6					20,000	2		5.5				
							Ave.	69½	53	31½	40	40,000	5¾	95	6.1				
							7					10,000			4.0				

School fumigated at 2:30 P.M. on % prevalence of Scarlet Fever in Chicago.

Fan running at 164 r.p.m.

Supply Velocity is result of spotting 12 points - 5 seconds each - repeated 3 times.

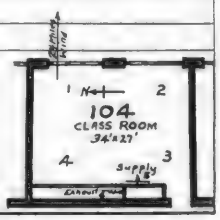
Exhaust Velocity is average of spotting and uniform travel - 4 times.

Station 1 = N.E. Cor, 2 = S.E. cor, 3 = S.W Cor, 4 = N.W Cor, 5 = Supply Reg, 6 = Exh Reg, 7 = Intake

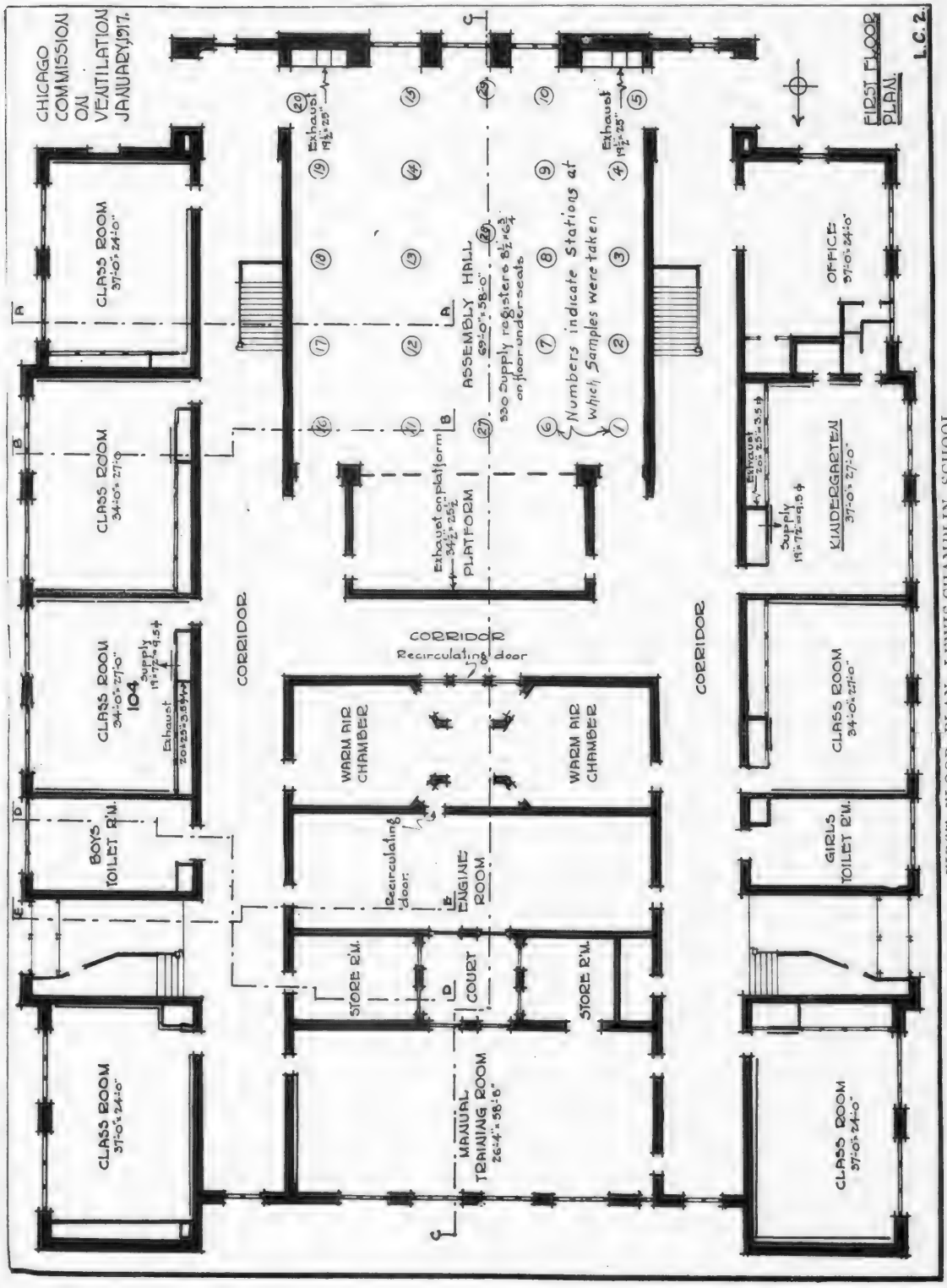
Air Motion: Dead space on south near floor. Rises from register strikes windows on east wall, drops and returns in breathing zone to exhaust under Blackboards on west wall. A few points in room without motion. Average = 40' per min.

Two CO_2 samples taken at each point - one following the other with all conditions the same. Neglect 2nd Battle at point 2.

Distribution = 88.2 %



TEST DATA FOR ROOM 104, LEWIS-CHAMPLIN SCHOOL.



FIRST FLOOR PLAN, LEWIS-CHAMPLIN SCHOOL.

observations. There was evidently a circular motion of the entire room air content, starting at the supply opening and gradually dropping toward the floor as the cooling influence became manifest. Thus, the CO_2 was higher at station 4 than at station 6. A quiet air space was observed between stations 2 and 3 under the blast of air from the supply opening. There was, at least, no objection to the motion observed. Some objection to the lack of motion might fairly be raised at certain points in the room.

2. The temperatures were excellent, and are supported by other observations of January 9, 10, 12 and 15, 1917. The temperature at the floor, near the outside wall was generally around five degrees cooler than the temperature in the center of the room, four feet above the floor. As there is no basement under the first floor, some justification is evident of the complaint by the teacher of a cold floor. It may be overcome, however, by heating the room for a longer time prior to occupancy.

3. The moisture content was 10% too low, according to the temperature, since with a 70° dry bulb, a 40% relative humidity is most comfortable.

4. The dust content was very high, both as compared with other rooms and with that outside. Much of it seemed to be in suspension in the room, and as the amount at the exhaust was less than that in the samples from the stations in the room, some local condition, such as recent agitation, perhaps by movement of the pupils, must be responsible. It is doubtful if the dust count of March 8 in room 104 means anything especially serious. Chalk dust was doubtless present, though all reasonable precautions were taken to present it.

5. The bacteria colonies in room 104 as compared with other rooms are rather low. They are strikingly low at station 3, under the supply. The same condition was noted January 9.

Kindergarten

MARCH 8, 1917

1. The amount of air delivered for each occupant was 41 cu. ft. per minute. Slightly more air was leaving the room at the exhaust than was entering at the supply opening, indicating inward leakage, probably through the outside wall. This is checked by the fact that the wind was from the west. The same relation of supply and exhaust openings is in effect as in room 104. As observed, the air distribution was very smilar to room 104.

KINDERGARTEN, LEWIS-CHAMPLIN SCHOOL.

The occupants were at station 1 when the CO_2 readings were taken, and the latter testify strikingly to this.

2. The room was too warm and this fact, together with the observations of January 9, indicate some improper air supply condition affecting the temperature, or poorly adjusted thermostats. Since the moisture content is fixed by the regulating instrument in another room, the temperature should be kept lower than 72, which is very close to the upper margin of the "comfort zone." The teachers have a tendency frequently (about every half hour) to open the windows. The thermostat may be set unduly high so as more quickly to compensate for this.

LEWIS-CHAMPLIN - GRAMMAR SCHOOL — MARCH 8, 1917

KINDERGARTEN - VOLUME: 12,240 CU.FT. - SUPPLY REG. 72"x19": 9.5# - EXHAUST REG. 25:20: 3.5# — L. C. 12

Time	Occupants	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vol. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Relative Humidity %	Air Motion Ft. per M.	Dust Particles Per Cu. Ft.	Bacteria 2 Min. Plate	Odors % Free From	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
1:00 to 2:00 P.M.	25 Pupils 3 Teachers	437	123	1170	360	1225	1	72	55	32		13,000	9		9.0 / 13.1	37	70	W	19
							2	72	56	36		"	7		5.9 / 7.5				
							3	73	56	34		"	4		6.3 / 4.9				
							4	72	55½	34		"	9		5.2 / 6.8				
							5					5,000			3.8				
							6					22,500	6		6.3				
							Ave.	72+	55.6	34	40	13,000	7	95	7.3				
							7					8,000			4.0				

School fumigated at 2:30 P.M. on 9% prevalence of Scarlet Fever in Chicago

Fan running at 154 r.p.m.

Supply velocity is result of spotting 12 points 5 seconds each - repeated 3 times

Exhaust velocity is result of spotting and uniform travel - 4 times

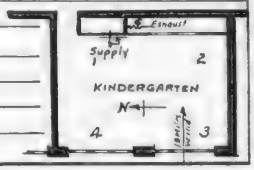
Stations: 1 = N.E. cor, 2 = S.E. cor, 3 = S.W. cor, 4 = N.W. cor, 5 = Supply reg., 6 = Exh. Reg., 7 = Intake

Air rises to ceiling from supply, strikes windows on west wall, and drops to floor - returns at heads to space under blackboards on east wall. Velocity of air in room about 40 ft. per minute

Two CO_2 samples were taken at each of the points - one following the other with all conditions the same.

Distribution: = 79%

All pupils and 2 teachers were in N.E. cor. at Station 1 when CO_2 readings were taken



TEST DATA FOR KINDERGARTEN.

3. The humidity checks fairly well with that of room 104. Some variation is accountable, since the moisture in the two sides of the building is supplied by different steam jets.

4. Very much less dust seems to be evident than in 104, and the relation borne by that in the room to that in the exhaust seems more logical. Tests made in January in this room indicated that the dust content increased about 25% when the occupants were running and jumping.

5. We do not observe any particular significance in the bacteria count, except that the bacteria followed the crowd and increased at station 1, while in 104 the corresponding point, not especially occupied was lowest in bacteria.

Room No. 201, and Check Test on Room No. 301.

1. Room 201 was tested in January, on March 9, and again on March 28. We show the test of March 28.

Each occupant was receiving 26 cu. ft. of air per minute. Although this room was on the windward side, the breeze did not overcome the fan pressure and 390 cu. ft. per minute were leaving the room elsewhere than at the exhaust. The location of supply and exhaust openings with reference to each other and the cooling surface is very different to that in effect in room 104. The supply is delivered in a direction parallel with the glass, and the exhaust is on the opposite side of the room along an outside wall. The cubic feet of space per occupant was 280, as compared with 340 for 104. The fan speed was but 2 R. P. M. slower than when 104 was tested.

The rather high average of CO_2 in the room (8.6) proves the anemometer observation of a deficient volume of fresh air. Contrary to the expectations of some of us, the CO_2 content

was very evenly proportioned at the four stations (at one 8.4; at two 7.9; at three 8.9; and at four 9 parts). The average CO_2 at the four stations was—at 2 ft. above the floor—9.4; at 4 ft. above the floor, 10.1; and at 7 ft. above floor, 6.3 parts. While the highest CO_2 at stations 1 and 2 was at 2 ft. above the floor, the highest at stations 3 and 4 was at 4 ft. above the floor.

As was expected, the whirling effect of the entire room contents, due to the location of the supply, caused a slightly higher CO_2 content at station 4. The test indicates that the stratum of contaminated air 4 ft. above the floor at station 4, is encountered at station 1 about 2 ft. lower down, on its corkscrew-like journey to the exhaust. Room 301 is directly over room 201, and is identical with it in arrangement. No flat comparison can be made, because of the difference in the number of occupants. Fresh air was being delivered at the rate of over 38 cu. ft. per occupant per minute, and each occupant had 355 cu. ft. of air space. The results, however, show very good distribution, with the corkscrew effect well marked, and nothing in any of the tests shows any reason, so far as air distribution is concerned, for criticising the plan of these rooms.

2. The tendency in both rooms on March 28 was to keep them unduly warm, with a low relative humidity. The tendency shown in all of the tests was to maintain room 201 at unduly high temperature.

3. It will be noticed that the outside relative humidity was but 36% as observed at the school; on March 9, with 60% relative humidity outside, room 201 was at 74° dry bulb, and 26% relative humidity.

4. The dust observations do not convey any particular information, except that they indicate some not unexpected

LEWIS-CHAMPLIN GRAMMAR SCHOOL — March 28, 1917 — L.C.21

ROOM 201 - VOLUME = 12,240 CU.FT. - SUPPLY REG. = 72" × 19" = 9.5 sq.ft. EXHAUST REG. = 25" × 20" = 3.5 sq.ft. — Including Test Before Occupancy.

Time	Occupants	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vol. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. per M.	Dust Particles Per Cu. Ft.	Bacteria 2 Min. Plate	Odors % Free From	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
9:00 A.M.	All Pupils		122	1160	220	770	1@2'	75	55	25			15		10.0	48	48	W.	18
to	1 Teacher		Fan @ 162 R.P.M.				1@4'	75	55	25			15		8.7				
10:15 A.M.	2 Exp'rs						1@7'	75	55	25			2		6.6	Observed at School			
Air &							2@2'	74	55	27			8		10.9	48	36		
Bacteria							2@4'	74	55	27			8		7.8				
taken at							2@7'	74	55	27			8		5.2				
10:00 A.M.							3@2'	73	54	27			14		8.6				
							3@4'	73	54	27			6		11.1				
							3@7'	73	54	27			8		7.2				
							4@2'	74	55	27			6		8.1				
							4@4'	74	55	27			12		12.8				
							4@7'	74	55	27			10		6.1				
							5					15,000			4.7 5.3				
							6					INTAKE 13,000	16		11.0 10.4				
10:00	44	280	122	1160	220	770	Room Aver.	74	54¾	26½	40	10,000	9	95	8.6				

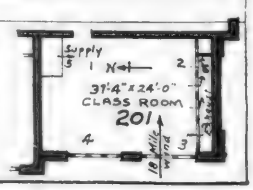
Fan started at 6:20 A.M. with air Recirculating and Vents open - Started test at 8:00 A.M. with following results.—

Dust - Intake = 39,000, Room 201 Sta. 1 = 15,000, Sta. 2 = 25,000, Sta. 3 = 20,000, Sta. 4 = 18,000, Sta. 5 = 12,000.

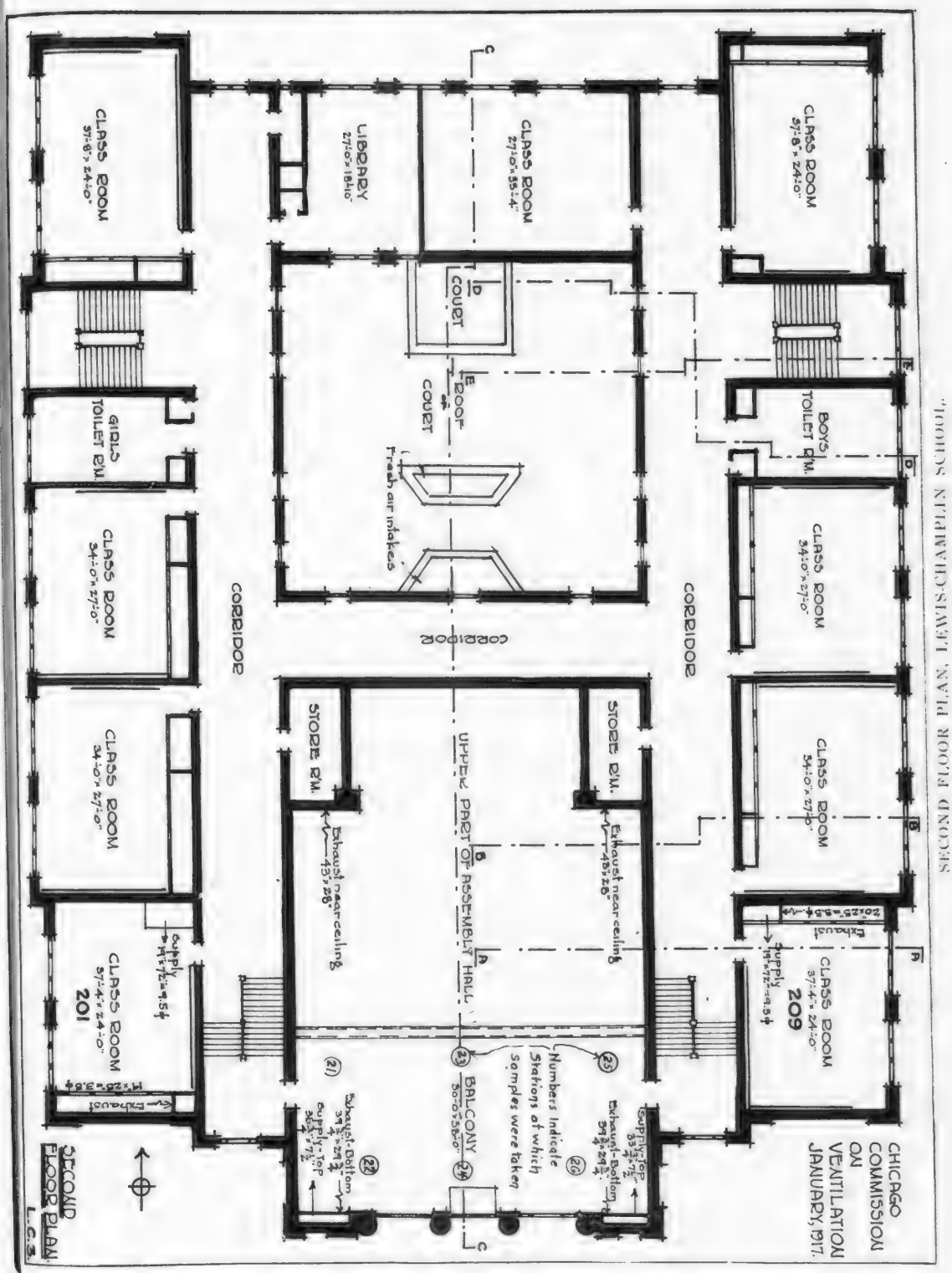
Fan operating 156 R.P.M. = 90/min. = 860 C.F.M. at supply. Temp. of Room = 77°-55° = 22% R.H.

CO_2 :- 4.7 at intake, 6.5 in Room 201. Bacteria = 18 at intake. Results are average of several samples

Recirculation discontinued at 8:10 A.M. No occupants in room except 2 testers.



TEST DATA FOR ROOM 201.



SECOND FLOOR PLAN, LEWIS-CHAMBERLIN SCHOOL, CHICAGO COMMISSION ON VENTILATION JANUARY, 1917.

variations, possibly due to sudden wind flurries at the intake. Some settling out of the dust into the long horizontal basement duct would be expected, since room 201 has one of the longest ducts, but such settlement was not indicated by the tests.

5. The bacteria colonies seem to check fairly well with the CO_2 observations. Note particularly the low count at station 1, seven feet above the floor, and the high count two feet above the floor. It indcates that in its circular movement around the room, the incoming air is diluted by contaminated air even at the 7-foot height, when it reaches station 4.

Room No. 209.

MARCH 9, 1917.

1. The amount of air delivery per occupant was 30 cu. ft. per minute. 330 c. ft. per minute were leaving elsewhere than at the exhaust, indicating an outward lee-side leakage of about one-fourth of the supply. The location of the supply and exhaust openings is the same with reference to the glass surface as in 201, but the exhaust is on the same side of the room as the supply. The fan was running at 10 R. P. M. below the speed in effect when 104 was tested. All of the tests in the room seem to be consistent and in our judgment show the best results to be expected from this type of plant.

2. The temperature was too high, and the humidity too low. Compared with the observations of January, there is indicated a tendency in the colder weather of January to keep the tempered air chamber too warm.

3. More moisture and lower temperature would have been better.

4. The dust observations are consistent with 104 and suggest chalk dust,

LEWIS-CHAMPLIN - GRAMMAR SCHOOL. MARCH 9, 1917.

ROOM 209 - VOLUME = 12240 CU FT - SUPPLY REG = 72° 19" 95th EXHAUST REG = 25° 20" 95th L.C. 27

Time	Occupants	Air Space per Occupant	Supply Vel. ft per M	Supply Vol. C.F.M.	Exhaust Vel. ft per M	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	% Relhum.	Air Motion Ft per M	Dust Particles Per Cu.Ft.	Bacteria 2 Min. Plate	Odors % Free From	CO_2	Weather Conditions Temp	R.H.	Wind Dir.	Wind Vel.
10:45	41 Pupils 1 Teacher	290	135	1280	272	950	1	70	52	27		51,000	6		6.8 8.0	35	60	S.W.	9
to							2	70	52	27		"	4		5.9				
11:15							3	70	52	27		"	8		5.3 5.8				
A.M.							4	70	52	27		"	3		7.0 6.6				
							5					16,000			5.0				
							6					35,000	9		7.7				
							Ave	70	52	27	40	51,000	5.2	90	6.45				
							7					14,000			4.2				

School was fumigated previous afternoon

Fan running at 154 r.p.m.

Supply Velocity is result of spotting 12 points - 5 seconds each - repeated 3 times

Exhaust Velocity is average of spotting and uniform travel - 4 times

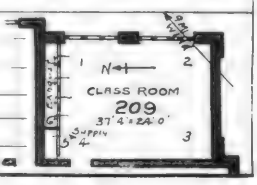
Station 1 = N.E cor, 2 = S.E cor, 3 = S.W cor, 4 = N.W cor, 5 = Supply Reg, 6 = Exh Reg, 7 = Intake

Air Motion: Drops to heads in advancing on West side - returns at heads on east side

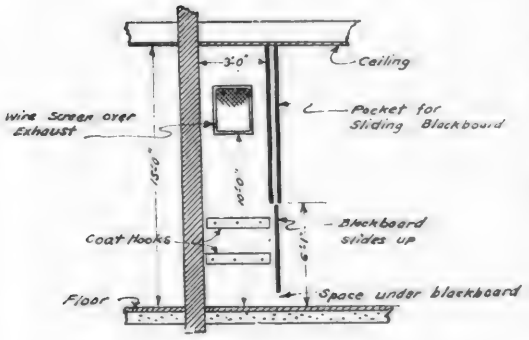
Two CO_2 samples taken at each point - one following the other, with all conditions the same - Neglect 2nd bottle of point 2.

Distribution = 90.3%

Dust in Room 209 was extremely fine on plates



TEST DATA FOR ROOM 209.



TYPICAL SECTION THROUGH WARDROBE, SHOWING METHOD OF EXHAUST VENTILATION.

or agitation by occupants. The number of dust particles and bacteria colonies apparently have no coordination.

5. The bacteria observations are consistent, and very interesting as compared with the results on the same day in 201, which is the same distance from the fan and which is symmetrical in every way with 209, except as to cubic feet of air supply per minute, per occupant, and as to relation of supply location to exhaust location. Room 201 had an average number of colonies three times as high as 209. The test of 201 of March 28 shows no such startling variation from 209. We cannot account for the difference, except perhaps because of recent movement within the room by the pupils.

Room No. 304.

MARCH 9, 1917.

1. The amount of air delivered per occupant was 44 cu. ft. per minute. 530 cu. ft. per minute were escaping elsewhere than at the exhaust and this against the light breeze. The relation of the supply and exhaust openings and the plan of the room duplicate room 209. No explanation is manifest for the poor showing as to CO_2 results, in a room the duplicate of 209, when each occupant was receiving nearly 50% more air per minute than 209. The effects of the adjacent old Lewis school may account for this. Possibly it may be that in 209 the occupants were in motion or had very recently been moving about, thus accounting for the tremendous dust count and the better dilution of the CO_2, while in 304 the dust shows low, with poor dilution, indicating that the occupants were quiet.

2. The temperature was satisfactory, but the relative humidity was too low. The tests of January indicate some tendency to overheat the tempered air, as mentioned before.

3. The relative humidity was reasonably consistent with the temperature. There is a strong indication that the temperature could not have been maintained much lower without increasing the humidity, and a probability that the limit of the moisture introducing apparatus had been reached.

4. There is strong evidence that the occupants were quiet, and that the blackboards were not being used.

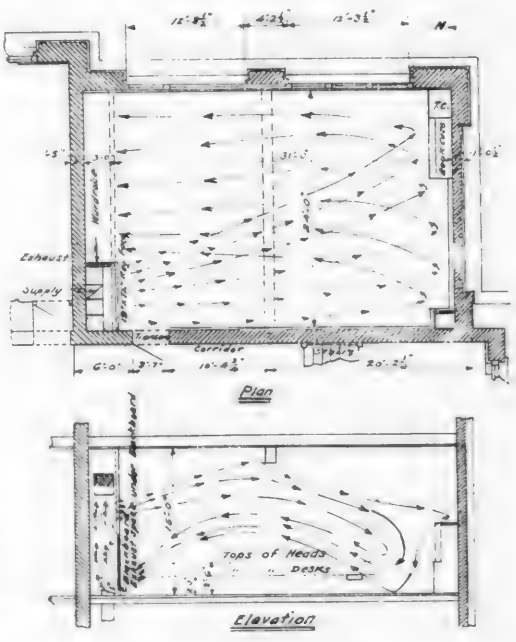


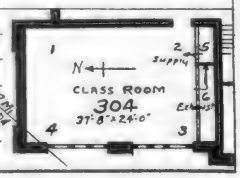
DIAGRAM OF AIR CURRENTS IN ROOM 209 AT TIME OF TEST.

LEWIS-CHAMPLIN — GRAMMAR SCHOOL — MARCH 9, 1917

ROOM 304 - VOLUME = 12240 CU. FT. - SUPPLY REG. = 12" x 19" = 9.5# EXHAUST REG. = 25" x 20" = 3.5# — L.C.32

Time	Occupants	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vol. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. per M.	Dust Particles per C.M.	Bacteria 2 Min. Plate	Odors % Free From	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
1:00	36 Pupils 1 Teacher	330	172	1630	315	1100	1	68	53	35		11,000	9		5.7 / 6.4	40	65	SW	9
to							2	68	53	35		"	11		8.8 / 9.0				
1:50							3	68	53	35		"	3		8.6 / 9.3				
PM							4	68	53	35		"	13		7.2 / 6.3				
							5					5,000			6.2				
							6					7,000			6.5				
							Ave.	68	53	35	40	11,000		90	7.5				
							7	-				14,000			4.2				

School was fumigated previous afternoon.
Fan running at 154 r.p.m.
Supply Velocity is result of spotting 12 points - 5 seconds each - repeated 3 times.
Exhaust Velocity is average of spotting and uniform travel - 4 times.
Station 1 = N.E. cor, 2 = S.E. cor, 3 = S.W. cor, 4 = N.W. cor, 5 = Supply Reg, 6 = Exh Reg, 7 = Intake
Air Motion - Drops to heads on east side and rises - returns on west side of heads
Two CO_2 Samples taken at each point - one following the other with all conditions the same
Distribution = 86 %



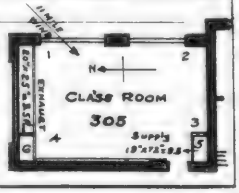
TEST DATA FOR ROOM 304.

LEWIS-CHAMPLIN GRAMMAR SCHOOL — MARCH 15, 1917

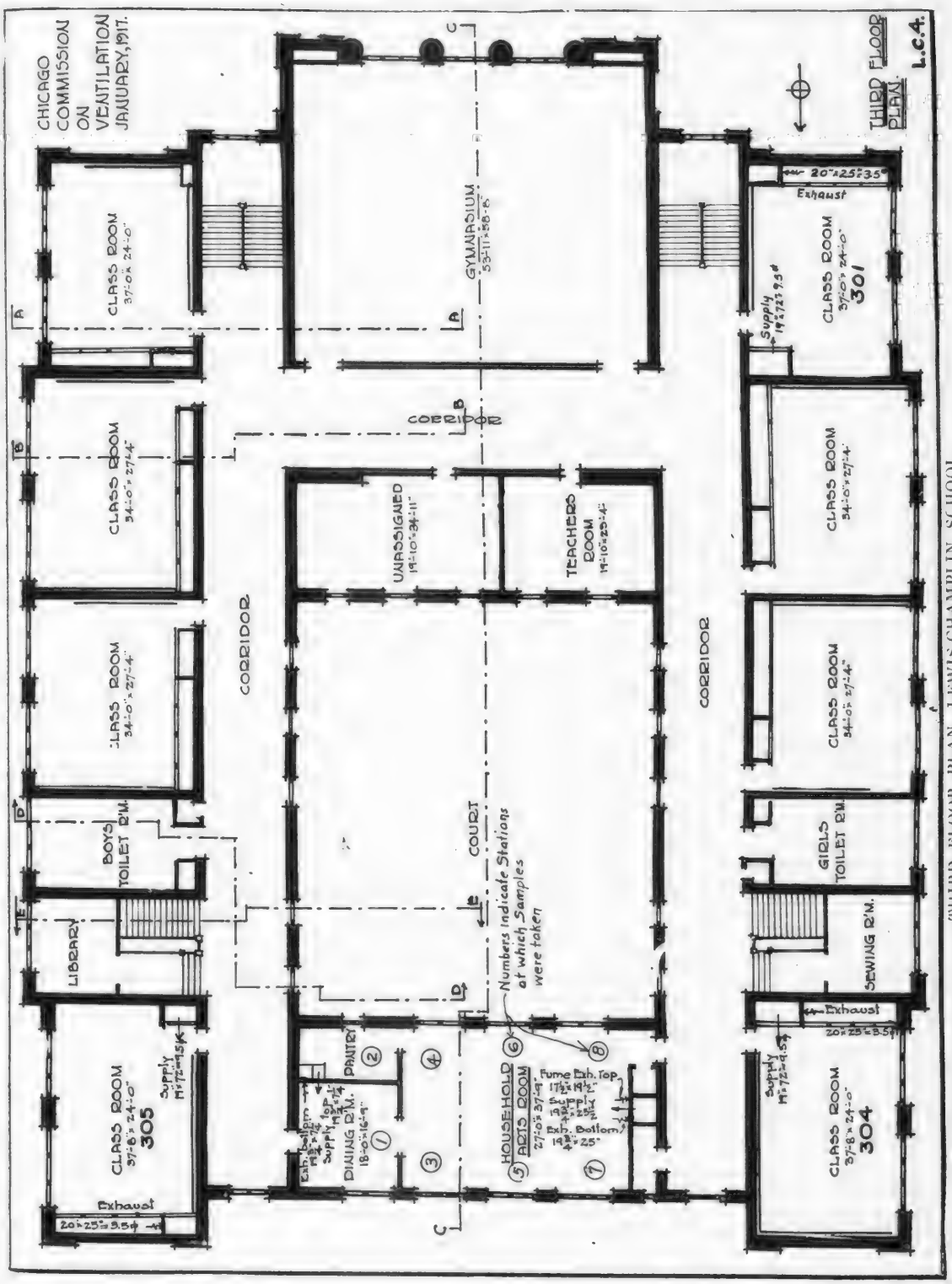
ROOM 305 VOLUME = 12,240 CU. FT. SUPPLY REG. = 12" x 18" = 3.5# EXHAUST REG. 25" x 20" = 3.5# — L.C.41

Time	Occupants	Air Space per Occupant	Supply Vel. Ft. per M.	Supply Vol. C.F.M.	Exhaust Vel. Ft. per M.	Exhaust Vol. C.F.M.	Station	Temperature Dry Bulb	Temperature Wet Bulb	Rel. Hum. %	Air Motion Ft. per M.	Dust Particles per Cu. Ft.	Bacteria 2 Min. Plate	Odors % Free From	CO_2	Weather Conditions Temp.	R.H.	Wind Dir.	Wind Vel.
12:30	43 Pupils 1 Teacher	280	135	1850	340	1190	1	74	54	24½		11000	4		6.5	35	65	N.E.	11
to							2	73	53	23		"	7		10.8				
1:15							3	73½	53½	23		"	15		6.4				
							4	74	54	24½		Supply 6500	10		7.3				
							7	40	34	52					3.8				
							6					11000	10		5.4				
							Ave.	73.6	53.6	23¾	40	11000	9	95	7.75				

Fan running 164 r.p.m.
Supply velocity is result of spotting 12 points - 5 seconds each - repeated 3 times.
Exhaust velocity is average of spotting and uniform travel - 4 times.
Stations 1 = N.E. cor, 2 = S.E. cor, 3 = S.W. cor, 4 = N.W. cor, 5 = Supply reg., 6 = Exhaust reg. 7 = at fan intake.



TEST DATA FOR ROOM 305.



THIRD FLOOR PLAN, LEWIS-CHAMPLIN SCHOOL.

5. The bacteria indications are fairly consistent.

Room No. 305.

MARCH 15, 1917.

1. The amount of air delivered per occupant was 42 cu. ft. per minute. 660 cu. ft. per minute were escaping elsewhere than at the exhaust. The room in plan is a duplicate of 201, as regards supply, exhaust, and exposure, except that the exhaust is on the north end, while in 201 it is on the south end. The fan was running at 164 R.P.M., two revolutions faster than when 201 was tested. The CO_2 observations indicate rather uneven distribution, and the occupants evidently were quiet. The average CO_2 content of 7.75 parts with 42 cu. ft. of fresh air supply per occupant does not check very satisfactorily with the careful tests of room 201 and 301, in which the physical conditions are similar.

2. The room was too warm. There is perfect means in the plant to correct this fault, and this could easily have been corrected.

3. The moisture content was too low for the temperature.

3. The dust in 305 was considerably lower than in the duplicate 201, indicating, however, that the occupants of 305 were quiet.

Discussion.

Only a small number of the tests actually made are shown herewith, for the reason that these tests merely established the technique, or verified the results shown. Tests were made of the conditions in effect when recirculating, but no conclusions can fairly be drawn from them, because of the constant shifting of the population of the building from room to room, in and out of doors, etc. Since, when recirculating, the corridors are used as a return duct, open doors and transoms could not be prevented. The recirculation apparatus is used only when warming the building prior to its occupancy, and then as a matter of econ-

A TYPICAL CLASSROOM (ROOM 305) IN THE LEWIS-CHAMPLIN SCHOOL.

omy. As a safeguard, there is an indicator in the principal's office, as well as in the engine room, showing when the air is being recirculated.

1. AS TO AIR VOLUME, DISTRIBUTION, AND MOTION.

As this plant is installed, the speed of the fan is governed by the steam engine governor, and may be varied within a considerable range by the engineer, without the knowledge of the occupants of the building. Naturally, the tendency of the engineer will be to run the fan fast enough to warm the building, regardless of the requirements of ventilaton. It is suggested that a recording revolution counter for each fan, the charts of which are regularly checked by the authorities, would be desirable. A variation of ten revolutions per minute in this apparatus would make a difference of nearly 25% of the volume of air delivered. There are ribbons at the supply openings in the rooms, but these are not any evidence of an adequate delivery velocity.

An attractive feature of the combined heating and ventilating plant at the Lewis Champlin School is that it is necessary, in order to heat the rooms, to ventilate them. The heaters are so proportioned that in cold weather at least, so low is the maximum possible temperature of the hot air, that full capacity ventilation becomes necessary in order to heat the rooms. When it is considered that the fuel and labor are in direct proportion to the amount of fresh air handled in a mechanical ventilating system, the importance of this feature will be clear. A serious objection to those ventilating systems separate from the heating system, such as are used in many cities other than Chicago, is the tendency of the operating engineers at every opportunity, regardless of occupancy to close down the ventilation.

The tests indicate as satisfactory distribution of the entering air as can be expected with the dilution principle of ventilation. The corkscrew-like travel of the air around the rooms, in a gradually downward direction toward the vents, causes each station to be swept by the air, and to this extent the effect of ventilation by displacement is approached. The occupants at points in the breathing zone nearer the exhaust opening must, of course, come in contact with some of the air contaminated by others earlier in the circuit, as evidenced by an occasional high CO_2 index. Owing to local conditions, such as corners, furniture, dead centers, etc., some other high CO_2 spots were noted. These would be overcome, if the occupants of the rooms were moving about. Undoubtedly, the distribution and also the dilution would be improved, if each room were provided with a local fan to increase the currents and encourage the mixing of the entering air with that in the rooms. Such currents, if not too high velocity, will, we know, promote comfort.

So far as these tests indicate, the location of the supply opening in relation to the location of the exhaust opening has little bearing. That is, the distribution of the air in the rooms tested was fully as good where the supply and exhaust openings were on opposite sides of the room as when they followed the common practice and were both on the same side of the room.

We must conclude from the tests that the distribution of the air in these rooms is as good as is ordinarily obtained in any room having ventilation on the dilution principle. As Chicago school buildings are now built, ventilation by dilution is apparently sought, for the supply and exhaust openings are extremely large, so as to minimize opportunities for high air velocities. The volume of the air handled was not always up to the requirement and

while this requirement could easily have been maintained, the plant is deficient in that no means are provided to insure a constant fan speed. The tests show the need for better distribution, and indicate to some extent the lines upon which improvement can be made.

2. AS TO TEMPERATURE.

The temperature in general was maintained at a higher point than we believe to be good practice, especially when it is possible, as it is possible here, to compensate by additional moisture content for a lower temperature. It is possible to maintain a maximum temperature of 68° F. in this building, but the tendency was to maintain 70° up to as high as 74°. We suspect, due to the unduly low humidity, that the desire of the teachers, rather than the best interest of the pupils, was consulted in setting the thermostats. With the apparatus installed, it would be as simple a matter to maintain 68° dry bulb temperature with 40% relative humidity as to carry 73° dry bulb and 25% relative humidity.

3. AS TO MOISTURE.

In general, better humidifying work can be done with an air washer, with control of the temperatures of both air and water when they are brought into contact with each other. The steam jets by our tests were doing very good work, but were not of sufficient capacity, or the controllers were adjusted too low. With the quality of Chicago water, no objectionable odor comes from the steam. With some water, due generally to the volatilazation of organic matter, the steam gives off an offensive odor and cannot be used satisfactorily for humidifying the air.

4. AS TO DUST.

The dust content is very high throughout. It seems from our tests to be no higher in the supply openings at the rooms than at the fan intake. Apparently, even if the fan handled dust free air, there would be a considerable dust content in the rooms, and this would be proportional very much more to the activities of the occupants of the rooms than to the amount of dust entering at the fan. All floors, except in the kindergarten, were oiled, and all practicable means were taken to eliminate chalk dust, but it appears from these tests that the dust in the rooms was largely foot-carried, and that it was diffused more by the activities of the occupants than by the ventilating system.

5. AS TO BACTERIA.

We believe little weight should be attached to the bacteria observations in this particular series of tests, as they seem to bear no especially marked relation to any other observed condition. We believe, however, that generally the bacteria count will be high when the dust content is high.

Conclusions

The tests at the Lewis Champlin School demonstrate the need for improvement in the design of the ordinary school room ventilating system, particularly as to the distribution of the fresh air. They indicate an opportunity for better operation, possibly for more nearly automatic control of volume, temperature, and humidity. By "automatic" we mean particularly the elimination of the human element. They show particularly the importance of further study as to means of reducing the dust content. It is not entirely clear whether the ventilating system, or other conditions, are of major importance, as affecting dust in school rooms.

The data gathered will be of the greatest value for comparative analysis with tests of other methods of ventilating in other buildings, which tests are now in progress by the Chicago Commission on Ventilation.

How to Use a Psychrometric Chart

Ten Typical Examples and Their Solution, Based on the Carrier Psychrometric Chart.

By J. I. LYLE,

President, American Society of Heating and Ventilating Engineers.

In all branches of engineering requiring more than the ordinary amount of calculation, it has long been the tendency to simplify the various computations, as far as possible, by the use of tables or charts, or both. In the field of thermodynamics no one subject has been in greater need of such simplification than air conditioning. Here we have a variety of problems in which a slight alteration of the conditions often makes an astonishing difference in the total results.

Since the development of air conditioning on its present extensive scale it has become a matter of the first importance for heating engineers to familiarize themselves with the principles involved. Up to the present time it is a matter of common knowledge that the average heating engineer has not brushed up on this subject to the extent he should in order to take advantages of his growing opportunities in this field.

Among the various noteworthy psychrometric charts that have been published is one designed by Willis H. Carrier and presented in a paper read before The American Society of Mechanical Engineers. This chart was acclaimed at the time as a classic of its kind and it immediately took rank as an authoritative exposition of the subject. Recently a new form of this chart has appeared, which is reproduced herewith.

It is generally recognized that much time and labor may be saved by the use of this and similar charts, but the fact remains that such saving depends to a very large extent on how familiar one becomes with the chart itself. In short, it is often true that while the advantages of a given chart are freely admitted, the time required to master its use often act as a deterrent to its widespread adoption.

In an effort to remove this possibility, as far as this particular chart is concerned, the following instructions have been prepared, in which almost every feature of an air conditioning problem has been presented and its solution shown on the chart.

INSTRUCTIONS FOR USE OF CHART.

All references to temperature are in degrees Fahrenheit.

Dry-bulb temperatures are represented by vertical lines, with values indicated on lower edge of chart.

Wet-bulb temperatures are represented by oblique straight lines, with values indicated on curved line marked "wet bulb temperature."

Dew-point temperatures are represented by horizontal lines and their values indicated on curved line marked "wet-bulb temperature."

Percentages of relative humidity are represented by converging curved lines, with values indicated between the oblique straight lines for 63° and 64° wet-bulb temperature.

Any two of the above properties may be found if the other two are known. First, find the point of intersection of the lines representing the given properties, and then follow through this point, the lines repre-

senting the unknown properties, and the values of the latter can be read from their respective scales.

Example 1.--Given: Dry-bulb temperature, 70°; wet-bulb temperature 60°. Find the percentage of relative humidity and the dew pont. Locate point of intersection of vertical line representing 70° dry-bulb temperature and the oblique line representing 60° wet-bulb temperature.

Reading from this point the percentage of relative humidity is 56 and the dew-point 53.4°.

Example 2. Given: Dry-bulb temperature, 80°; relative humidity, 59%. Find the dew-point and wet-bulb temperature. Locate the point of intersection of the vertical line representing 80° dry-bulb temperature and the curved line representing 59% humidity.

Reading from this point, the dew-point is 64.8° and the wet-bulb temperature 69.5°.

Example 3. Given: Dry-bulb temperature, 75°; dew-point temperature, 55°. Find percentage of relative humidity and wet-bulb temperature. Locate the point of intersection of the vertical line representing 75° dry-bulb temperature and the horizontal line representing 55° (wet-bulb scale).

Reading from this point the relative humidity is 49.8% and the wet-bulb temperature 62.3°.

Example 4. Given: relative humidity, 50%; wet-bulb temperature, 60°. Find dry-bulb temperature and dew-point. Locate the point of intersection of the curved line representing 50% humidity and the oblique line representing 60° wet-bulb temperature.

Reading from this point, the dry-bulb temperature is 71.7° and the dew point 52°.

Example 5. Given: wet-bulb temperature, 55°; dew-point, 50°. Find dry-bulb temperature and relative humidity. Locate the point of intersection of the oblique line representing 55° wet-bulb temperature and the horizontal line representing dew-point of 50°.

Reading from this point the dry-bulb temperature is 61.5° and the relative humidity 68%.

Example 6. Given: Relative humidity, 40%; dew-point, 40°. Find dry-bulb temperature and wet-bulb temperature. Locate the point of intersection of the curved line representing 40% relative humidity and the horizontal line representing 40° dew point.

Reading from this point, the dry-bulb temperature is 65.02° and the wet-bulb temperature 52°.

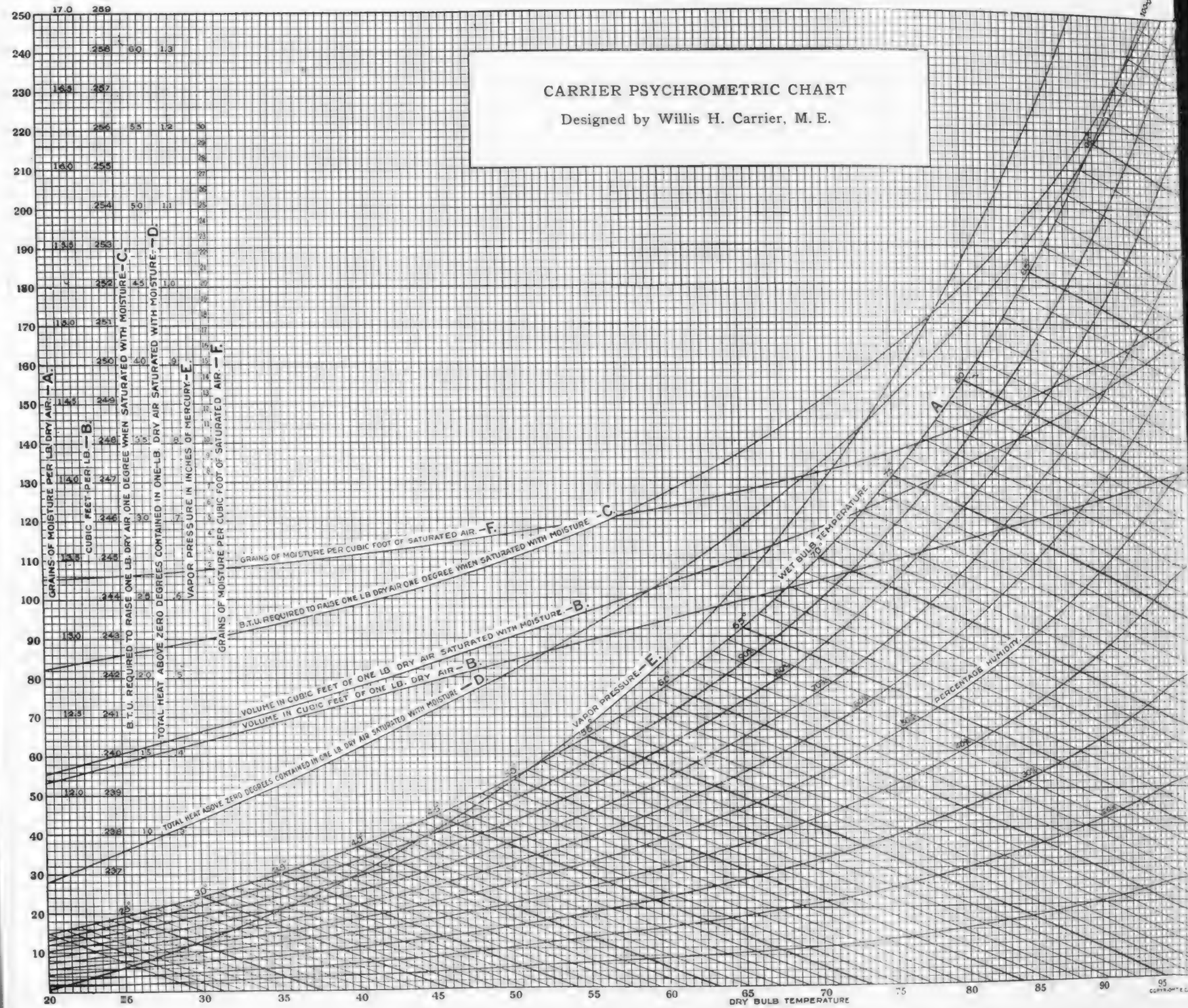
TOTAL HEAT OF AIR

The total heat of air is a function of its wet-bulb temperature, as described and proven by Willis H. Carrier in his rational psychrometric formulae. In the chart, it is taken for the sake of convenience as *above zero, degrees Fahrenheit.*

The total heat in B. T. U. is represented by horizontal lines with values indicated at the left by the scale D, "Total Heat Above Zero Degrees Contained in One Pound of Dry Air Saturated with Moisture."

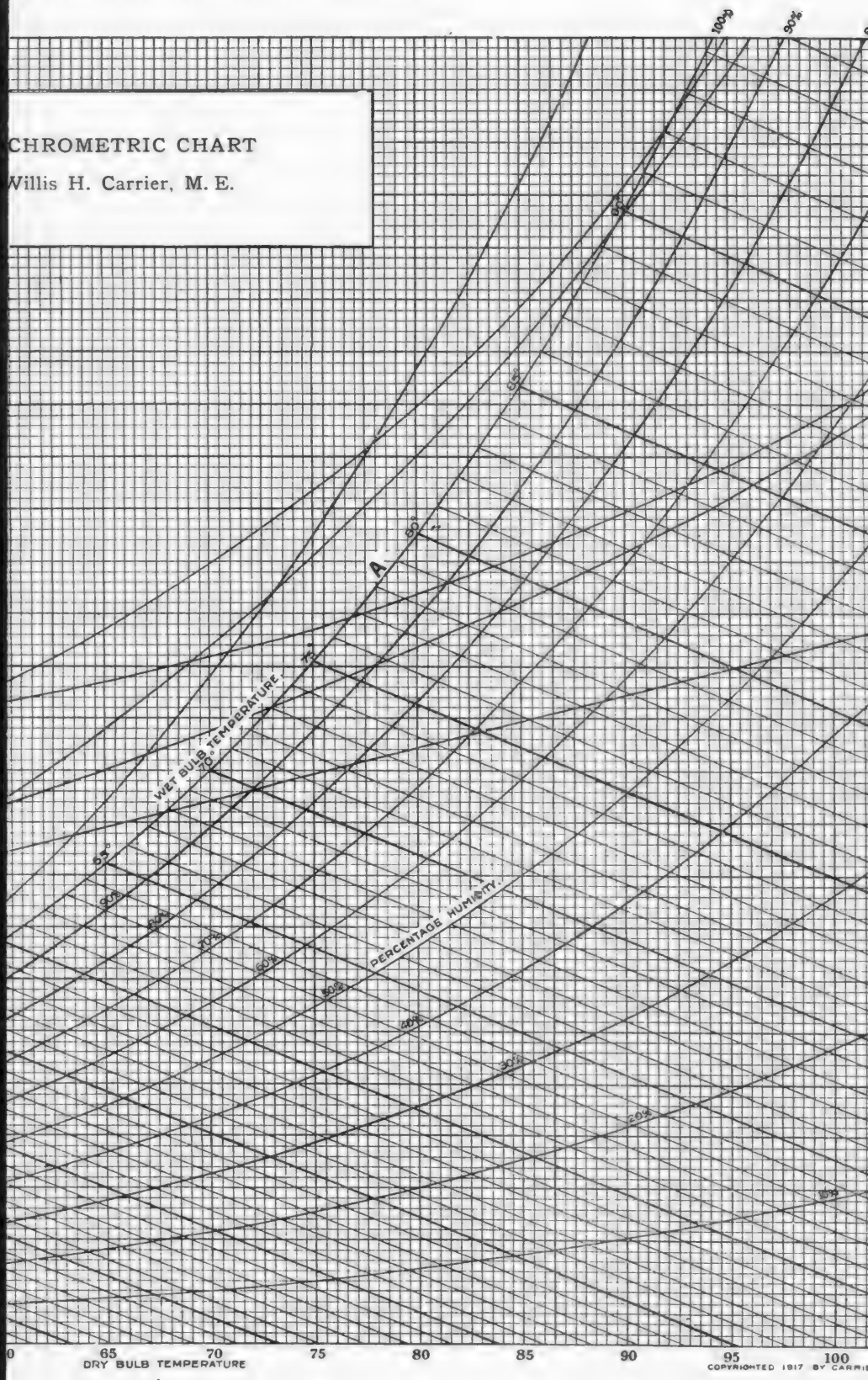
To find the total heat, the wet-bulb temperature must first be determined. Then follow the vertical line through the wet-bulb temperature reading at 100% humidity, to the "Total Heat" curve D. The horizontal line through this point of intersection represents the total heat above zero, and the value is indicated on the scale D at the left.

Example 7. Given: Dry-bulb temperature, 70°; relative humidity 60%. Find the total heat. The wet-bulb temperature determined by the method used in Example 2, is 61°. Following the vertical line through the point representing 61° wet-bulb temperature and 100% relative humidity, to its intersection with curve D and then reading horizontally to scale D on the left, the total heat above zero degrees in

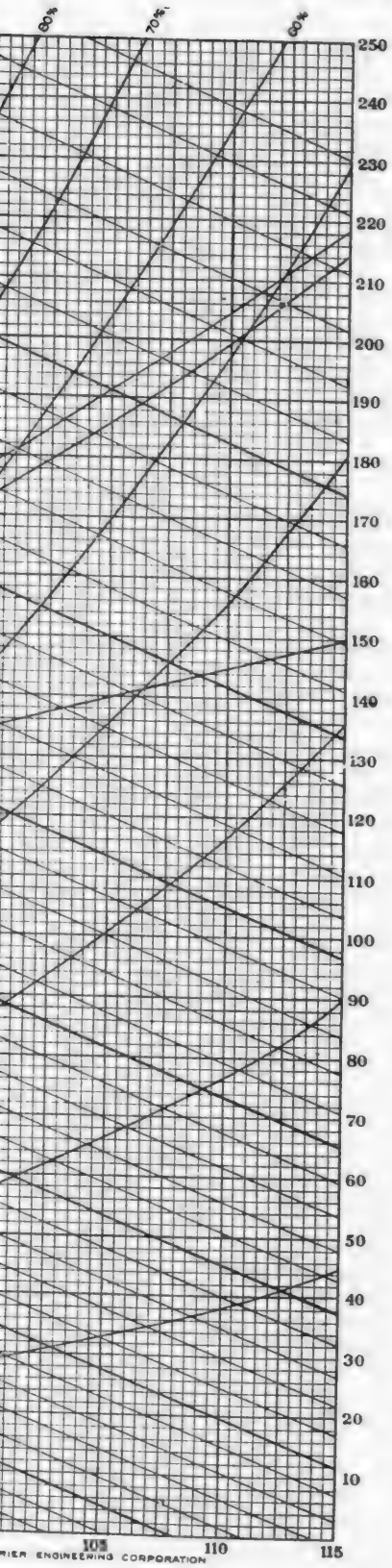

CARRIER PSYCHROMETRIC CHART
Designed by Willis H. Carrier, M. E.
GRAINS OF MOISTURE PER LB. DRY AIR.—A.
CUBIC FEET PER LB.—B.
B.T.U. REQUIRED TO RAISE ONE LB. DRY AIR ONE DEGREE WHEN SATURATED WITH MOISTURE.—C.
TOTAL HEAT ABOVE ZERO DEGREES CONTAINED IN ONE LB. DRY AIR SATURATED WITH MOISTURE.—D.
VAPOR PRESSURE IN INCHES OF MERCURY.—E.
GRAINS OF MOISTURE PER CUBIC FOOT OF SATURATED AIR.—F.
GRAINS OF MOISTURE PER CUBIC FOOT OF SATURATED AIR.—F.
B.T.U. REQUIRED TO RAISE ONE LB DRY AIR ONE DEGREE WHEN SATURATED WITH MOISTURE.—C.
VOLUME IN CUBIC FEET OF ONE LB DRY AIR SATURATED WITH MOISTURE.—B.
VOLUME IN CUBIC FEET OF ONE LB. DRY AIR.—B.
TOTAL HEAT ABOVE ZERO DEGREES CONTAINED IN ONE LB DRY AIR SATURATED WITH MOISTURE.—D.
VAPOR PRESSURE.—E.
WET BULB TEMPERATURE
PERCENTAGE HUMIDITY
DRY BULB TEMPERATURE
COPYRIGHTED

CHROMETRIC CHART

Willis H. Carrier, M. E.



COPYRIGHTED 1917 BY CARRI


80%
70%
60%
250
240
230
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
105
110
115
RIER ENGINEERING CORPORATION

one pound of given air is 26.7 B. T. U. The total heat to be removed in cooling air between two temperatures is found by substracting the total heat at the lower temperature from that at the upper as follows:

33.5 B.T.U., Total heat above zero degrees (dry bulb 70°)
26.7 B.T.U., Total heat above zero degrees (wet bulb 61°)
6.8 B.T.U. Heat to be removed by cooling.

ABSOLUTE HUMIDITY (GRAINS OF MOISTURE PER CUBIC FOOT)

Absolute humidity is a function of the dew-point and may be expressed either in grains per pound or dry air or in grains per cubic foot.

The grains of moisture per pound of dry air are represented by horizontal lines with values indicated on the scale A, "Grains of Moisture per Pound of Dry Air."

To find the grains of moisture per cubic foot for air under given conditions, first determine the grains per pound of dry air by finding the intersection of the (vertical) dry-bulb line and the (oblique) wet-bulb line and reading from there horizontally to scale A, "Grains of Moisture per Pound of Dry Air" at the left.

The volume in cubic feet per pound of dry air is represented by horizontal lines with values indicated by scale B, "Cubic Feet per Pound."

Find the points of intersection of the (vertical) dry-bulb temperature line with the curves B, "Volume in Cubic Feet of One Pound of Dry Air Saturated with Moisture" and "Volume in Cubic Feet of One Pound of Dry Air." Follow these horizontally to the left and read the values on scale B. The difference in these two readings of volumes is the extra volume due to moisture at 100% humidity.

To obtain the direct volume of the moisture per pound of air under the given conditions, find the volume of water vapor for the given percent. of humidity and add it to the volume of dry air.

Then grains of moisture per cubic foot or in other words the absolute humidity, is

$$\frac{\text{Grains per pound of dry air}}{\text{Cubic feet per pound of mixture}}$$

Example 8. Given: Dry-bulb temperature, 70°; wet-bulb temperature, 60°. Find the absolute humidity (grains of moisture per cubic foot).

Reading vertically on the 70° dry-bulb line and obliquely on the 60° wet-bulb line to the curve marked "Wet-Bulb Temperature", and from there horizontally to Scale A, the number of grains of moisture per pound of dry air is 61.

Then locate the points of intersection of the vertical dry-bulb line for 70° with the two curves B, and follow these horizontally to scale B at the left.

13.7 cu. ft.—Volume of one pound of dry air saturated with moisture.
13.38 cu. ft.—Volume of one pound of dry air.
0.32 cu. ft.—Extra volume due to moisture at 100% humidity.

(In instances where the air is *saturated* or *dry*, its volume may be found directly by locating the point of intersection of the [vertical] dry-bulb line with the corresponding curve B and referring to the scale B.)

The percentage of humidity for air under the given conditions is indicated where the 70° dry and 60° wet-bulb lines intersect, which by interpolating between the 60° and 50° humidity curves is 57%.

57% of 0.32 is 0.1824 cu. ft., volume of moisture in the given air.

13.38 cu. ft.—volume of dry air.
0.1824 cu. ft.—volume of moisture.

13.5624 cu. ft.—volume of one pound of the given mixture.

$$\frac{61 \text{ gr. per lb.}}{13{,}5624 \text{ gr. per cu. ft.}} = 4.499 \text{ grains of moisture per cubic foot.}$$

Vapor Pressure in Inches of Mercury depends upon the dew point and is represented by horizontal lines with values indicated by the scale E "Vapor Pressure in Inches of Mercury."

To determine the vapor pressure, read horizontally from intersection of (vertical) dry-bulb line with (oblique) wet-bulb line. Read through the wet-bulb temperature scale A and the "Vapor Pressure" curve E to the scale E at the left. The reading here is the vapor pressure. It should be noted when getting the reading for saturated air that the dew-point, wet- and dry-bulb temperatures are identical.

Example 9. Given: dry-bulb temperature 70°; wet-bulb temperature, 60°. Find the vapor pressure.

Reading vertically on the 70° dry-bulb line to the point of intersection with the (oblique) 60° wet-bulb line, and then horizontally through the wet-bulb temperature curve A, through the dew point and (wet-bulb reading is 53.5°) to the vertical scale E, "Vapor Pressure in Inches of Mercury." The vapor pressure for this point reads 0.405 inches.

TO FIND THE RESULTING RELATIVE HUMIDITY WHEN HEATING OR COOLING AIR WITHOUT CHANGING ITS DEW POINT.

Find the dew-point line for the given conditions which is the horizontal line through the point of intersection of the (vertical) dry-bulb line with the (oblique) wet-bulb line. Follow this line horizontally to the new dry-bulb temperature line and read the percentage of humidity for this point of intersection.

Example 10. Given: dry-bulb temperature, 70°; wet-bulb temperature, 60°. Find the resulting relative humidity when the air is heated to 80° (dry-bulb temperature).

The point of intersection of (vertical) 70° dry-bulb and (oblique) 60° wet-bulb lines indicates an existing humidity of 56%. Following the point of this indication horizontally to intersection with the (vertical) 80° dry-bulb line and the relative humidity reading on the curve is 40%.

A Notable Heating and Ventilating Index

A remarkable compilation of data regarding sources of information on heating and ventilating work and on mechanical equipment in general has been compiled by the American Institute of Architects and published in its Journal for October, 1917. The preparation of the index was in direct charge of D. Knickerbacker Boyd, associate editor of the Journal.

The index starts off by giving a list of the societies and associations interested in this field.

EDUCATIONAL AND RESEARCH WORK.

Under "Educational and Research Work," the following reference is given: "In THE HEATING AND VENTILATING MAGAZINE, April, 1917, it is stated that President Lyle, of the A. S. of H. and V. Engineers has appointed a committee to investigate the matter of the establishment of a bureau of research to be conducted under the auspices of the Society. When John Bartlett Pierce, one of the founders of the American Radiator Company, and its vice-president, died at his home in Lynnfield, Mass., June 23, 1917, his will was found to create a substantial surplus fund to be used for the establishment of the John B. Pierce Foundation for technical research in heating, ventilating, and sanitation 'to the end that the general hygiene and comforts of human beings and their habitations may be advanced.'"

"Boilers and Heating in General" is ex-

tensively treated, with a number of sub-headings. Under "Departments of U. S. Government" are given the titles of a number of Government publications, special attention being called to the fact that "the U. S. Weather Bureau compiles for THE HEATING AND VENTILATING MAGAZINE complete records of the weather in five different localities, which are published, with charts and complete data."

The second sub-heading, "Boiler Standards" refers to the boiler code of the A. S. M. E. and gives the titles of a number of books and articles dealing with this subject. It also speaks of the American Uniform Boiler-Law Society which exists for the purpose of promulgating the A. S. M. E. Code as the legal boiler construction code for all the States. It is stated that the code is now operative in nine States and eight municipalities.

RATING HOUSE HEATING BOILERS.

Under the third sub-heading, "Rating and Testing of House Heating Boilers," the work of the National Association of Master Steam and Hot Water Fitters is mentioned, as well as that of the heating engineers' society. Note is made of the fact that the heating engineers' society has a committee on "Code for Testing Low-Pressure Heating Boilers." This committee expects to make a final report at the coming January meeting of the society. Prominence is given in the index to a letter received from a prominent manufacturer of boilers connected with an important association who states:

"If the American Institute of Architects could bring about the establishment of a standard method of rating heating boilers it would mean a great step forward in boiler manufacturing.

"Practically every boiler manufactured today, no matter what its catalog rating, will actually develop its catalog rating, but the manufacturer does not tell how it has to be handled to develop its rating. Some boilers, to deliver their rating, have to be fired every four hours with a draft so intense that it almost equals a forced draft, so great is the rate of combustion per square foot of grate. Such a condition, of course, is not reasonable for a heating plant, and the only way to eliminate it is to surround the definition of how a boiler should be rated with certain safeguards.

AMOUNT OF HEATING SURFACE REQUIRED ON HOUSE-HEATING BOILERS.

"For maximum economy with any kind of fuel, a boiler should be proportioned so that at least one square foot of heating surface should be given for every 3.45 lbs. of water to be evaporated from, and at 212° F. per hour.

"For each 100 sq. ft. of standard direct cast-iron radiation in still air, or its equivalent, 7.25 sq. ft. of heating surface should be used, or that each square foot of heating surface in heater take care of 13.8 sq. ft. of standard direct cast-iron radiation or its equivalent, which is 3.45 lbs. of water per hour from and at 212° F.

"The above figures are based on the calculation that for each square foot of direct radiation, ¼ lb. of water is condensed per hour from and at 212° F. The heating surface is as recommended by the American Society of Mechanical Engineers.

"Due to the wide difference in coal, it is impossible to specify the exact ratio of grate to heating surfaces, but the following will cover the situation.

"That a grate area or its equivalent be furnished so that a firing period of not less than eight hours may be obtained."

HEATING IN GENERAL.

Under "Heating in General," the fourth sub-head, attention is called to the various works on the subject. The reader is also referred to the "Review of Current Technical Literature" in the Journal of the A. S. M. E. Other references are given as follows:

The A. S. of H. and V. E. is conducting investigations to determine the relative efficiency of a heating plant during the different periods of the heating season, dividing it up into periods of twenty days for each period and considering a heating season as 160 days, more or less, the first ten days and the last ten days being considered as one period and so on; this will determine the efficiency of the plant at slow, medium and maximum combustion, and thus determine the relative efficiency of each rate of combustion from a number of such tests.

The following reprints of papers issued by the A. S. of H. and V. Engineers are given:

1. "Design of Indirect Heating Systems —Maximum Economy and Operation," F. L. Busey and W. H. Carrier, 1913. 10 cents.

2. "Heating and Ventilating of Federal Buildings," N. S. Thompson, 1910, 10 cents.

3. "Development in Heating and Ventilating Industrial Buildings," E. L. Hogan, 1915, 10 cents.

4. "Office Practice in Estimating Heating and Ventilating," J. D. Small, 1912, 10 cents.

5. "Heating a Swimming Pool," C. Teran, 1912, 10 cents.

6. "Report of Committee on Steam Heating Residences," 1910, 10 cents.

7. "Hot Water heating system of Crane Company's Chicago Works," F. E. McCreary, 1917, 10 cents.

The following articles are also cited which appeared in THE HEATING AND VENTILATING MAGAZINE:

1. "Notes on the Rise of the Smokeless Boiler," October, 1916.

2. "Relative Economy of Heating by Steam at Different Pressures," A. Bement, February, 1917.

3. "The Care of a Vacuum Heating System in the Summer Months," August, 1917.

4. "A Survey of Operating Costs in Thirteen School Buildings, Jamestown, N. Y.," J. M. Cushman, November, 1916.

5. "The Comparative Effects of wind and sunshine on Buildings," D. B. Prentice, June, 1916.

6. "Fuel Economies in House Heating," H. R. Johnson, December, 1916.

7. "Failure to Heat Premises—Tenant's Remedy," February, 1916.

8. "An Extensive Open-Tank Gravity Hot Water Heating System," George Stumpf, Jr., October, 1914.

9. "Hot Water Heating on a Large Scale, New York State School of Agriculture," November, 1915.

Other references are as follows:

"Lefax" issues, among others, the following data sheets:

1. "Heating," from "Mechanical Equipment of Federal Buildings," N. S. Thompson, Chief Mechanical and Electrical Engineer, Supervising Architect's Office. (3-52.)
2. "Design of Steam and Hot Water Heating Systems," M. William Ehrlich. (4-96.)

See "Mechanical Equipment of Buildings," a reference book for engineers and architects, by Louis A. Harding and Arthur C. Willard.

1. Volume I: "Heating and Ventilation." A reference book for architects and engineers, 1916. 619 pp. The authors have found it necessary, in their own experience to make extensive use of manufacturers' data in designing the various mechanical systems or plants required in modern buildings. They have therefore not hesitated to include such data in the text, in order to illustrate and facilitate the design of similar systems in each subject treated.
2. Volume II: "Power Plants and Refrigeration."

"School Architecture," W. G. Bruce. Fourth edition. For architects and school authorities. Chapter on Heating and Ventilating treats most of the subjects in this issue.

"Handbook for Heating and Ventilating Engineers," James D. Hoffman. With tables and charts, on design and installation, widely used in colleges.

"The Heating and Ventilating of Buildings." Rolla C. Carpenter.

"Manual of Heating and Ventilation," F. Schumann.

The Mechanical Equipment of Federal Buildings under Control of The Treasury Department, N. S. Thompson, has chapters on:

I. Heating and Ventilation. II. Commercial Practice in Regard to Heating Factory and other Buildings. III. Commercial Practice in Regard to Heating by forced Circulation of Hot Water from a Central Station.

This book, written by the Chief Mechanical and Electrical Engineer, office of Supervising Architect, is especially interesting as an exemplification of the practice in that office and contains, besides data elsewhere referred to, discussions on general practice, schedules of piping sizes, sample specifications of the office, estimating data for apparatus in new federal buildings, ducts, flues, tables, and other information applicable to all features of heating and ventilating in all kinds of buildings.

"Heating and Ventilating Plants," Charles L. Hubbard. Covers heating and ventilation as applied to all classes of buildings, from the small, furnace-heated dwellings to structure of the largest size. 300 pp., illus.

"Heating and Ventilation," C. L. Hubbard. A practical manual of hot-air, steam and hot-water heating, and of modern systems of ventilation. 256 pp., illus.

See "Heat Engineering," Arthur M. Greene, Jr.

"Notes on Heating and Ventilation," Prof. John R. Allen. A résumé of lectures delivered to classes in heating and ventilation at the University of Michigan. 272 pp.

"Mechanical Equipment of School Buildings," Harold L. Alt. 112 pp., illus. Contains Chapters as follows (other Chapters referred to elsewhere):

I. Heating and Ventilating. II. Ducts and Flues. III. Heating and Ventilating Special Rooms. IV. Ventilating Toilets and Laboratories. XIV. The School Power Plant. XVIII. Vacuum Cleaning.

"The Ventilation, Heating and Management of Churches and Public Buildings," J. W. Thomas. 148 pp., illus.

"Modern Theatre Construction," Ed-

ward Bernard Kinsila. Contains information on Heating and Ventilation.

"Heating by Hot Water, Ventilation and Hot-Water Supply," Walter Jones. 360 pp., illus.

"Hot-Water Heating and Fitting," William J. Baldwin. 306 pp., illus.

"Warming Buildings by Hot Water," Frederick Dye. 319 pp., illus.

"Practical Steam and Hot-Water Heating and Ventilation," Alfred G. King. Contains rules, tables, and 300 illustrations, showing in detail all the various heating systems, with pipe, radiator and boiler connections.

"Steam Heating for Buildings," Wm. J. Baldwin, M. Am. Soc. C. E. Descriptive of steam heating apparatus for warming and ventilating large buildings and private houses. 404 pp., illus.

"Heating by Steam and Hot Water," Charles B. Thompson. Has short rules for computing radiation, heat-losses, charts, illustrations, and descriptions of how best to heat water for baths, swimming-pools, etc. 265 pp., illus.

The Engineering Experiment Station of the University of Illinois issues:

1. "The Economical Purchase and Use of Bituminous Coal for Heating Homes." A new bulletin. 2. A circular on the installation of a house-heating system, showing the most economical methods of firing soft coal and operating a house-heating plant.

See *"Building Code"* recommended by the N.B. of F.U., 1915. Part XXVI, pp. 173-184, entitled "Chimneys, Flues and Heating Apparatus," contains Sections 178-185 on Chimneys, Smoke-Flues, Gas-Flues and Fireplaces; Smoke-Pipes; Heating Furnaces and Appliances; Stoves and Ranges; Hot-Air Pipes and Registers; Steam and Hot-Water Pipes; Vent-Flues and Ducts; and Dry Rooms. Includes diagrams.

See "Field Practice," Inspection Manual of the N.F.P.A., 1914. Contains sections as follows:

1. Sec. II: "Heating Hazards." Treats of Radiation and Conduction of Heat; Effect of Continuous Heat upon Heating Devices; Furnaces and Heating Devices of a Fixed or Stationary Type —Grading of Furnaces—Setting and Mounting — Clearance — General Features of Installation; Furnace Stacks, Chimneys and Flues, Breeching-Features of Installation; Hand or Movable Furnaces; Special Treatment of Miscellaneous Heating Devices; Common Miscellaneous Hazards, in connection with Use of Heat (including: Blower Systems for Heating, Ventilating, Stock and Refuse Conveying).
2. Sec. III: "Power Hazards, including Refrigeration." Treats of Steam Boilers; Electric Power—Electric Motors; Gas and Gasoline Engines; Fuel-Oil under Boilers and Furnaces, and for Domestic Use; Refrigeration.
3. Sec. VII: "Chimneys and Flues." Treats of proper construction of chimneys and flues and gives Instructions for Repairing Old Chimneys.

"A Handbook for Superintendents of Construction, Architects, Builders, and Building Inspectors," H. G. Richey. 357 pp. Superintendent of Construction, U. S. Public Buildings.

"Building Foreman's Pocket Book and Ready Reference," H. G. Richey. 1,118 pp., 656 figures.

See "The Building Estimator's Reference Book," Frank B. Walker, 1917. Contains a chapter on "Steam and Hot-Water Heating," pp. 3,200-3,207, which gives data for estimating steam and hot-water heating, sizes and costs of boilers, pipe and fittings, radiation and bronzing.

"Principles of Heating," by William G. Snow.

BLOWERS AND FANS.

A section is devoted to "Warm Air Heating, Stoves, Ranges and Dryers," and this is followed by a section on "Blowers, Fans and Ventilation in General." This section has the following references:

(See the references under Heating in General, the majority of which contain sections covering the subjects included in this heading.)

1. The A.S.H. and V.E. is cooperating with biologists, physiologists, sanitarians, and psychologists to determine, if possible, whether the air in buildings is necessarily less healthful than the outer air, and if so, why. This work is covering a wide range of research and a thorough investigation into every phase of the subject.

   It is investigating the question of improvements in washing and conditioning the air to further improve the art of ventilation and is conducting experiments to standardize the various operations necessary to furnish adequate ventilation.

   Its committees are at work formulating requirements for ventilating buildings to guide the various state legislatures in making up codes for the regulation of such requirements in public and semi-public buildings.
2. See "Report of Committee on Minimum Ventilation Requirements for Public and Semi-Public Buildings for

Legislation Purposes" of the A.S.H. and V.E. Contains General Suggestions on Compulsory Ventilation, applicable to all classes of buildings, and Special Minimum Heating and Ventilating Requirements applying to all Schools, Colleges, Factories, Workrooms, Theatres, and Motion-Picture Houses. 23 pp.

3. Reprints of papers by the A.S.H. and V. E.:

"Report of Committee on Blower systems," A. M. Feldman. 1914. 10 cents.

"Report of Committee on Fan Blast Heating (1)." 1909. 10 cents.

"Report of Committee on Schoolroom Ventilation." 1913. 10 cents.

"New York State Commission on Ventilation—1915," Geo. T. Palmer. 1916. 20 cents.

"Open Windows with Mechanical Ventilation," R. C. Taggart. 1912. 10 cents.

"Ventilation of Telephone Booths," R. L. Douglass. 1914. 10 cents.

"The Centrifugal Fan," F. L. Busey. 1915. 20 cents.

"Report of Committee on Method of Taking Anemometer Readings." 1913. 10 cents.

4. See "Suggested Regulations of the N.B.F.U. for Blower Systems for Heating and Ventilating, Stock and Refuse Conveying as Recommended by the N.F.P.A." These have also been published in the *Heating and Ventilating Magazine* as Standard Heating and Ventilating Data Sheets, August, 1917.
5. "Ventilation Laws in the United States," published by the Heating and Ventilaing Magazine Company. Contains Board of Health Requirements and Regulations of N.B.F.U., together with Model Ventilation Requirements as Promulgated by the A.S. of H. & V.E. 178 pp.
5. "Some Modern Methods of Ventilation," R. Grierson. 187 pp. With special reference to public buildings. Contains information for health authorities, architects, heating, sanitary and electrical engineers, sheet-metal workers, and others who may be called upon to install ventilating apparatus.
7. See "The Design of Blower Heating Systems for Factory and Shop Buildings," L. A. Harding and J. A. Moyer. Published by the Pennsylvania State College Engineering Experiment Station in Pennsylvania State College Bulletin, June, 1913. 60 pp.
8. The Ventilation Hand Book, C. L. Hubbard. 218 pp. and diagrams relating to Ventilation as applied to Furnace Heating Ducts, Flues and Dampers for Gravity Heating; Fans and Fan-work.
9. "The Ventilation of the School-room," Wm. J. Baldwin, M.E. 46 pp., illus.
10. "The Ventilation, Heating and Lighting of Dwellings," J. W. Thomas. Illus.
11. "The Fan," Charles H. Innes. 1916. 302 pp., illus. Includes the Theory and Practice of Centrifugal and Axial Fans, revised by W. M. Wallace and F. R. Jolley.
12. See "Motion-Picture Houses in New York City Inadequately Ventilated," *The Heating and Ventilating Magazine*, May, 1916.
13. For notes on "Air Cooling of Houses," from an address by Alexander Graham Bell in *National Geographic Magazine*, see The Builders' Guide of Philadelphia, October 10, 1917.

DUCT CHARTS.

(*a*) "Tables for Ventilating Ducts," Chouteau E. Pearce, M.E., published on stiff cards by the Heating and Ventilating Magazine Company. These tables are useful in rapidly estimating superficial area and weights of galvanized sheet-iron rectangular ducts, as usually employed in ventilating work. 50 cents.

(*b*) "Chart for Figuring Round and Rectangular Ventilating Ducts," Chas. A. Fuller. *The Heating and Ventilating Magazine*, August, 1916.

(*c*) See Pohl's Everready Pipe and Elbow Chart. 54 pp.

AIR CONDITIONING AND TEMPERATURE CONTROL.

The section on "Air Conditioning, Temperature Control," has the following references:

Publications listed under Heating in General will be found to treat of these subjects.

1. These are also embraced within the activities of the A.S. of H. & V.E. in connection with Ventilation investigations, and in the Report of the Committee on Minimum Ventilation Requirements it is stated:

"Temperature control, preferably of an automatic type, shall be required for all heated and ventilated rooms. The temperature regulator, whether by automatic or hand control, shall be so arranged that its operation will not decrease the required volume of air-supply for ventilation."

2. The A.S. of H. & V.E. is investigating to determine the best method of dust prevention and humidifying the air from furnaces, and to regulate or control the same. Also to test and determine the

value of temperature-controlling devices for hot-air apparatus.

3. The following reprints of papers by the A.S. of H. & V.E. are of interest:
   (*a*) "Report of Committee on Air Washers," 1910. 10 cents.
   (*b*) "Preliminary Report of Committee on Standardizing the Testing of Air Washers," A. E. Stacey, Jr. 1914. 10 cents.
   (*c*) "Humidity in Relation to Heating and Ventilation," L. C. Soule. 1912. 10 cents.
   (*d*) "Improved Air Conditions in a Boston Residence," F. I. Cooper. 1913. 10 cents.
   (*e*) "Studies in Air Cleanliness," G. C. Whipple and M. C. Whipple. 1915. 10 cents.
   (*f*) "Problem of City Dust," R. P. Bolton. 1915. 10 cents.
   (*g*) "Temperature Equivalents of Wind Velocities," H. W. Whitten. 1912. 10 cents.
4. See *Heating and Ventilating Magazine:*
   (*a*) "New Ideas in Air Conditioning," W. E. Watt. February, 1916.
   (*b*) "Air Conditioning for Factory Offices." May, 1917.
   (*c*) "Tests of Air Conditions in an Illinois School," E. V. Hill, M.D. May, 1916.
   (*d*) "Heating and Ventilation of School Buildings." Washed recirculated air compares favorably with fresh air. September, 1916. (See, also, correspondence, October, 1916.)
   (*e*) "A Simple Method of Figuring the Economy of Humidity." May, 1917.
   (*f*) "Fuel Economy with Increased Humidity." March, 1917
   (*g*) "Humidity and Automatic Control." Harold L. Alt. July, 1916.
   (*h*) "Re-establishment of Temperature Control on a central Station Hot Water Plant." April, 1917.
5. The literature of manufacturers of these specialities will usually be found to go fully into details.

CHIMNEYS, FLUES AND FIREPLACES.

Some notes are given on "Natural Ventilation," the next section being "Chimneys, Flues and Fireplaces," which reads as follows:

In the design of these, efficient proportions and construction tightness should be the first consideration, as a protection against fire and to afford a proper draft. The successful operation of any installation may be greatly impaired, if not entirely defeated, by inadequate size or lack of tightness in the joints of the flue.

The N.F.P.A. and the N.B.F.U. have issued valuable illustrated literature on the subject. Drawings and descriptions are to be found therein and in many of the handbooks and other publications.

Valuable data for calculating the area, height, design, erection and successful use of chimneys and flues will be found in many of the publications listed under "Heating in General" and "Hot-Air Heating," and in some of the hand-books and literature of manufacturers who are alive to the necessity of providing adequate draft as a precedent to satisfactory operation of any plant.

The A.S. of H. and V. Engineers proposes experiments to determine a standard for the size and height of chimneys and the strength of draft needed for a given operation; the value of round and square chimneys; the relative efficiency of smooth tile-lined compared with the ordinary brick flues; the effect on the draft of diving and underground flues; the friction and heat loss necessary to overcome the extra travel; the explanation in a practical manner of the laws governing drafts in chimneys and for formulating a standard method of building chimneys to prevent defective drafts.

Read "Chimneys: Their Design and Construction," by Harold L. Alt, in THE HEATING AND VENTILATING MAGAZINE for March and April, 1917. Mentions common errors in chimney work, describes the use of draft gauge and methods to obviate chimney leakage, gives recommendations for construction, making connections and a table for calculating sizes of flues for residences in proportion to cubical contents of building. Contains illustrations and table of commercial sizes and areas of flue tile. Gives designing data for chimneys and power plant stacks, friction loss charts for brick and steel stacks, and a theoretical draft chart for stacks.

"Chimney Design and Theory," by W. W. Christie. A book for engineers and architects. 200 pp., illus. Contains formulas, tables, wind-pressure, flues, lightning protection, general information.

"Chimney Design," edited from various sources, by Walter Loring Webb, C.E. "Lefax" data sheet No. 4-106.

See THE HEATING AND VENTILATING MAGAZINE:

"Things to Remember About Chimneys," by E. C. Molby, October, 1916.

The "Ideal Fitter," of the American Radiator Company gives, in connection with each boiler described and illustrated, the

size and height of chimney flue required. It also contains "Notes on Chimney Flues," with a table of commercial sizes of tile and unlined brick flues.

PIPES, VALVES AND FITTINGS.

"Pipes, Valves and Fittings" are the subject of the following references:

1. The A.S.T.M. has adopted "Standard Specifications for Welded Steel and Wrought Iron Pipe."
4. A.S.M.E. Standards recommended in reports of committees received by the Council of the Society and separately published on:
   (*a*) Standard pipe, pipe-threads and pipe-unions.
   (*b*) Identification of power-house piping.
   (*c*) Standard threads for hose-couplings.
   (*d*) Standardization of pipe-thread gages.
   (*e*) The American Standard for pipe flanges, fittings and bolting.
5. The National Association of Master Steam and Hot Water Fitters issues:
   (*a*) The 1915 U. S. Standard Schedule of Flanged Fittings and Flanges, on which is stated: "The dimensions of the 'American Standard' are identical with the above, and this Schedule was adopted March 20, 1914, by a joint committee of this Association, the A.S.M.E., and the Committee of Manufacturers on Standardization of Fittings and "Valves." Cardboard. 24x35 inches. $1.
   (*b*) The same as a Chart 9x12 inches.
   (*c*) A folder giving separate schedule of the "Standard" flanges and "extra heavy" flanges.
6. The N.F.P.A. prints in "Proceedings":
   (*a*) Reports of Committee on Standardization of Pipe and Pipe Fittings.
7. The A.S. of H. & V.E. has issued Reports of Committee on Corrosion in pipe, and is now collecting data relating to sizes of pipes used in steam- or water-heating plants; will tabulate such data that the sizes needed for any part of a plant will be readily understood, and continue experiments to add what data may be needed to complete the subject.
8. "Dimensions and Weights of Pipe and Fittings," compiled by the Editors of *Power*. Covers all standard pipes and their fittings.
9. See "Lefax" Data Sheets, as follows:
   (*a*) "Economical Design of Steam Piping," A. Langstaff Johnson, Jr.
   (*b*) "Resistance of Pipes to Internal and External Pressure," K. F. Adamson.
10. "The Friction of Water in Iron Pipes and Elbows," paper by F. E. Giesecke, of the University of Texas, read before A.S. of H. & V.E., July, 1917.
11. See HEATING AND VENTILATING MAGAZINE:
   (*a*) "Pipe Symbol Chart," T. W. Reynolds. February, 1916.
   (*b*) "A Handy Chart for Determining the Weight of Pipe," W. F. Schaphorst. March, 1917.
   (*c*) "Pipe Hangers," Harold L. Alt. March and April, 1916.
   (*d*) "A British Tribute to the Superiority of American Pipe." October, 1916.
   (*e*) "Importance of Supervising Piping in Customers' Buildings," D. E. Karn, of Consumers' Power Company, Grand Rapids, Mich. August, 1917.
12. "A Handbook on Piping," Carl L. Svensen. 350 pp., illus. Has convenient information and data on piping, fittings, pipe joints, valves, piping drawings, pipe lines, and their accessories.
13. "Pipes and Piping," Hubert E. Colling. Included in the contents are: Steam-pipe conduits; pipe fittings; sizes of pipe; how to distinguish steel from iron pipe; a color scheme for pipe lines; effect of superheated steam on cast-iron valves and fittings.
14. "The Design of Valves for Use in High Class Buildings," M. W. Link. Paper No. 172 in the *Journal of the Society of Constructors of Federal Buildings*, March, 1915, pp. 133-142.
15. Pipe Fitting Charts, Wm. G. Snow. 284 pp., 220 figures of piping and apparatus for hot-water, steam, and other types, including ducts.

RADIATORS, REGISTERS AND GRILLES.

Under "Radiators, Registers and Grilles," is given the following:

The A. S. H. and V. Engineers has special committees to determine the most effective place for a radiator in a room and to recommend a standard method of testing radiators. Investigations are being conducted to determine: (*a*) the relative value or ratio of one-, two-, three- and four-column radiators; (*b*) the relative value or ratio of different heights of radiators from 18 to 45 in.; (*c*) the effect of painting, bronzing or enameling radiators; (*d*) the loss in efficiency when the radiator is enclosed in a recess with only the front exposed, with the front covered with a grill, with the radiators all enclosed with only an opening at the bottom for air and a register at top in proportion to the surface in the radiator; (*e*) the ratio of efficiency of a window radiator enclosed under a seat; (*f*) the

ratio of fresh-air inlet and warm-air outlet per square foot of indirect surface; (*g*) the ratio of register to indirect surface, to determine the frictional resistance of the ornamental face of a register.

The following reprints of papers by the A. S. H. and V. Engineers are of interest:

1. "Wall Radiators vs. Long Pipe Coils," J. A. Donnelly, 1906. 10 cents.
2. "Effect of Painting Radiator Surfaces," J. R. Allen, 1909. 10 cents.
3. "Determining the Volume of Air Passing Through Register," J. H. Kinealy, 1897. 10 cents.
4. "Comparison of Pipe Coils and Cast-Iron Sections for Warming Air," J. R. Allen. 10 cents. Contains tests demonstrating that condensation for both types of surface depends upon friction of air through the heater.

See THE HEATING AND VENTILATING MAGAZINE:

1. "Determination of Radiator Sizes for Hot Water Heating Plants," Freywid Wegelius. January and April, 1916.
2. "Best Position for a Radiator in a Room." September, 1916.
3. "Requirements for Radiator Humidifiers." E. P. Lyon. August, 1917. Contains description of new type capable of evaporating 2.9 gal. per square foot of hot water radiator per day.
4. "Apparatus for Testing Heat Transmission from Radiators." May, 1916.

METAL WORK AND DUCTS.

Under "Metal Work, Ducts, Chase Lathing," are listed the following articles from THE HEATING AND VENTILATING MAGAZINE:

"Standard Practice for Sheet Metal Work in Ventilating Systems," T. W. Reynolds. December, 1916.

Comparison of various Methods of Figuring Duct and Flue Sizes," Harold L. Alt. October, 1916.

HEAT TRANSMISSION, INSULATION AND COVERINGS.

The remaining sections are devoted to "Air Leakage, Guarantees and Formulas," "Heat Transmission, Insulation, Coverings," and "Mechanical Equipment in General—Power Houses and Cold Storage Plants." The section on "Heat Transmission" is as follows:

1. The A.S. of H. & V.E. is collecting and tabulating data of all tests relating to heat-losses through building materials. It will collate the results of new tests till the heat-losses of all materials used in a modern building have been ascertained, and then maintain authoritative data for use as a basis in determining the heating surfaces necessary for buildings of various types.

   It will collect data relative to the heat-loss through covering materials and make tests to verify them and determine the value of insulating materials used for insulating buildings, boilers, pipes, cooling pipes, cooling machinery, and other apparatus.
2. In an address before the N.A.M.S. and H.W.F. in June, 1916, by D. Knickerbacker Boyd, the editor of the Journal's "Structural Service Department," he said, "In the matter of sectional covering and banding on lateral runs, plastic covering on flanges, couplings and fittings, and on the heating apparatus itself, surely some standards of practice could be developed which would greatly aid in establishing a uniform basis of estimating."
3. See "Specification for 85 per cent Magnesia Non-Conducting Coverings for Power and Heating Systems" (received March 8, 1917, but not dated), described in a letter, from Prof. Thomas Nolan, Chairman Committee on Materials and Methods, A.I.A.
4. The Low Pressure Covering Manufacturers' Association has under consideration the recommendations of its Standard Committee for a specification on Air Cell and Wool Felt Covering. It is expected that specifications for the uniform proper application of such coverings will be given consideration later on.
5. See "List of Inspected Mechanical Appliances," published by Underwriters' Laboratories, for Heat Insulating Coverings and Pipe Coverings.
6. See "Mineral Resources of the U. S.," issued by U. S. Geological Survey, 1915, Part II, "Nonmetals," for Chapter on "Asbestos."
7. See "Practical Laws and Data on the Condensation of Steam in Covered and Bare Pipes," C. P. Paulding. To this is added a translation of Péclet's "Theory and Experiments on the Transmission of Heat Through Insulating Materials." 107 pp. Illus.
8. See "Transmission of Heat Through Cold-Storage Insulation," C. P. Paulding. Formulas, Principles, and data relating to insulation of every kind. 41 pp., illus.
9. See Reprints of Papers by the A.S. of H. &V.E.:
   (*a*) "Heat Transmission with Pipe Coils and Cast Iron Heaters," L. C. Soule. 1913. 10 cents.
   (*b*) "Heat Losses through Building Materials," L. A. Harding. 1913. 10 cents.
   (*c*) "Heat Losses and Heat Transmis-

sion," Walter Jones. 1906. 10 cents.
(*d*) "Heat Transmission through Building Materials," John R. Allen. August, 1916.

10. See THE HEATING AND VENTILATING MAGAZINE:
(*a*) "Government Experiments on Heat Transmission through Walls." September, 1916.
(*b*) "Effect of Velocity and Humidity of Air on Heat Transmission through Building Materials," J. A. Moyer. February, 1916.
(*c*) "The Heat Insulating Properties of Commercial Steam Pipe Coverings," L. B. McMillan. January, 1916.

11. The Bureau of Standards, in addition to several commercial tests, has been making investigations upon about twenty-five different kinds of materials, the samples being purchased in the open market. These include flax, asbestos, and cork products, and a wide variety of special materials. An investigation of the thermal conductivity of wood is in progress, several varieties having been meaured. The very great importance of confined air-spaces in the construction of insulating walls led to an extended investigation of the laws governing heat transmission by confined air, which is being continued.

Recent Development of the Baldwin Air Cooling, Drying and Purifying Apparatus.

About two years ago William J. Baldwin, of New York, designed an apparatus that could be placed in the porthole or the deadlight of a ship and which would exclude the rain or spray, while freely admitting large quantities of air to the cabin of the ship, without admitting the water. This led to freeing the air of an excess of humidity.

A description of Mr. Baldwin's machine was given at the last annual meeting of the heating engineers' society and published in THE HEATING AND VENTILATING MAGAZINE for February, 1917.

A further description is given in a paper presented by Mr. Baldwin at the recent meeting of The American Society of Mechanical Engineers in which he states:

The experiments conducted with the preliminary apparatus for excluding rain or spray while freely admitting the air as in the case of a ship rolling heavily at sea, suggested the possibility of removing the excess of humidity in the air, particularly with a view to admitting air to the radio room of a ship, and not only exclude the rain and spray but also regulate the humidity, so as to keep the air at *some common standard of saturation* as far as humidity was concerned. The purpose was to overcome a difficulty with the attuning apparatus of the receiving and sending instruments, either at sea or in the higher atmosphere.

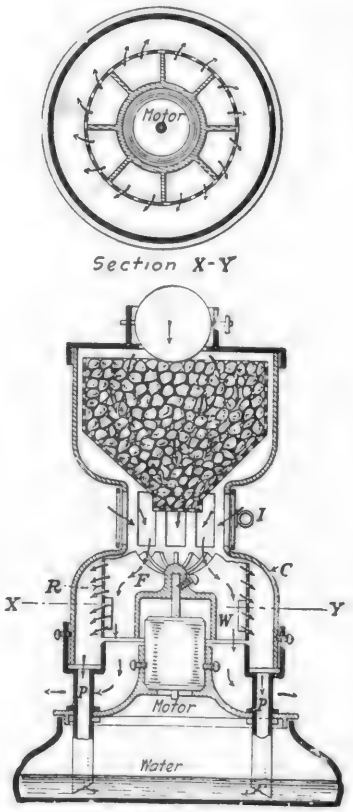


FIG. 1—BALDWIN AIR DRYER AND COOLER, SHOWING PRINCIPLE OF CONSTRUCTION.

This led to the design of an apparatus for a radio room on the lines already set forth, that would admit air not only separated from rain, salt spray and spume, but that would also condition or regulate the humidity within the room by keeping it at a common standard of humidity, regardless of the outside changes.

Cold water in the spray form will do this, provided the spray can be gotten rid of after it has combined with the excess of humidty (steam in the air) and then separated from the air by some practicable form of apparatus that is simple and clean, and that occupies small space.

While "a shower of rain will clear the atmosphere," the elements of nature have all outdoors in which to set up the apparatus for such a result. The cabin of a

ship or a radio cabinet is infinitely small in comparison with all outdoors, yet a similar result can be achieved in a space as small as a cabin or radio cabinet.

To accomplish this I used a cold-water spray apparatus similar to one I had designed two years earlier for the purpose of precipitating the CO_2 when found in great excess in a confined space, as in the hold of a submarine, when forced to stay a long time under water.

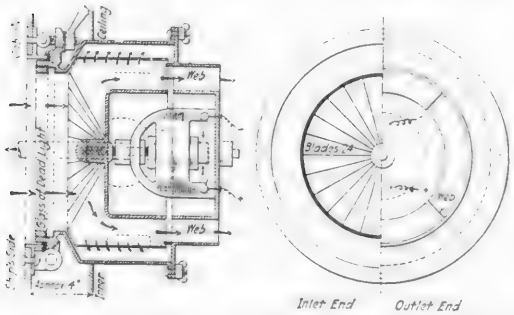


FIG. 2—APPARATUS ATTACHED TO PORT-HOLE OF SHIP.

In this machine a spray of potash water was used in connection with a mechanical dust precipitator for the purpose of seizing on the carbonic acid in the air and throwing it down, so as to eliminate the CO_2 at the dust and water discharge of the apparatus.

It was proposed to put the apparatus in a bulkhead; the discharge side of the apparatus coming into the air of the living quarters, the air freed of its CO_2 being forced back again into the chamber of greatest vitiation, thus forming a cycle.

In the general experiments it was found that a prepared spray of chemical liquid or even cold water not only seized on the dust but on the other gases in the air, with which the chemical in the spray would combine, and that a pure-water spray turned into the apparatus would keep the humidity of the air constant by suitable regulation of the temperature of the water spray. In a room of 90° F. and a humidity of almost 90%, we could drop the humidity to 45% by reducing the temperature of the spray to 70° F.

A simple form of the apparatus arranged for cooling a room is shown in Figs. 1 and 2. The apparatus from the inlet to the line X-Y (Fig. 1) is an ordinary fan or blower F, and the downward extensions of the fan blades or wings W are necessary to accelerate the rotary motion of the air.

The rotor R is a rotating hoop of mermeable metal, against the inner side of which the air is thrown with all its impurities. If the heavy particles in the air, such as dust, mud or particles of water, strike into the perforations of the hoop, they pass through into a quiet space formed by the outer case C. Or, if they strike on the solid part of the hoop, they are rubbed through the nearest holes by the forward movement of the air. They then pass into the quiet space C, drop down within it, and escape by the pipe or pipes P into the tank.

The air does not escape with the heavy particles, as might appear at first, for the lower ends of the pipe legs are sealed by the water in the tank. The tank may be of any shape, or there may be no tank, the separated particles going to a waste pipe.

The greater the velocity of the rotor R the more efficient is the apparatus. A speed of 5000 ft. per min. is very practicable, but 10,000 is not excessive, either from the point of bursting or for any other reason.

FIG. 3—APPLICATION OF APPARATUS TO CHIMNEY FOR REMOVING DUST FROM FLUE GASES.

The fan gives the same static pressure as any other centrifugal blower of equal diameter and speed and requires only equal power for equal work, and the power required for separation and friction is considerably under 25% of the blower power required to move the air.

The device as described above illustrates the principle of the various types of apparatus, whether used for taking the dust from the air, the CO_2 from a chimney or an enclosed space, the excess of humidity from the air, throwing down fog, cooling and moving air, etc. It will be noted that the ice in the upper tank serves both as a cooling medium and for the supply of cold water, broken into spray by the rapid motion of the fan, for the purification of the air.

THE HEATING AND VENTILATING MAGAZINE

A Monthly Journal of Engineering Progress

Member of the Associated Business Papers Inc.

Vol. 15 January 1918 No. 1

Published Monthly at Cooperstown, N. Y., by the
Heating and Ventilating Magazine Co.
Executive and Editorial Offices, 1123 Broadway
New York

A. S. ARMAGNAC.....*President*
GUSTAVE PETERSEN....*Secretary and Treasurer*

A. S. ARMAGNAC, Editor
GUSTAVE PETERSEN, Business Manager
HAROLD L. ALT, Contributing Editor

European Representative:
W. G. HOLLINWORTH, 304 High Holborn
London, W. C.

Subscription.....$1.00 per year
Canada..... 1.25 " "
Foreign Countries..... 1.50 " "
Back numbers..... 15 cents each
Back Nos. prior to current year.. 25 cents each

AMERICA is not awake to the war," cries the pessimist, as he throws open his office window to cool his overheated room and turns on another light. "We have got to realize that our industrial resources must be mobilized, as well as our men," he declares, finishing his day's work and walking out, leaving each radiator and electric light going at full blast. His evening paper tells him that there must be conservation of fuel and he marvels why people in these times can be so careless as to waste a single pound of coal.

Multiply this case by hundreds of thousands and we have a composite picture of what is happening in almost as many office buildings at this particular time. Conservation in general has meant little or nothing to most of us and fuel conservation not much more.

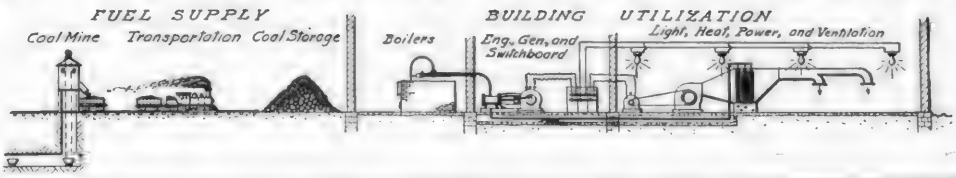
Suddenly there came the startling announcement, "The United States Face to Face with a Fuel Famine." How quickly we responded to that alarm and lost no time in getting in touch with our home coal dealer. The transition from passive interest to active concern was everywhere most striking.

In these last few weeks the country has realized that in this important matter the avenues of waste are appalling. While the campaign for a 68° F. indoor temperature will no doubt help, the great demand of the moment is for the prevention of wasted heat and light. Let every office-building tenant not only put a stop to this waste in his own office, but bring the matter to the attention of his building manager, so that there may be some concerted and uniform action in the matter. As one of the speakers said at a recent meeting of heating engineers, "It is a common sight to see great clusters of electric lights burning, in broad daylight, in many offices, while it is almost invariably the practice to leave radiator valves open all the time in offices and hotels, taking it for granted, apparently, that they are equipped with thermostatic control."

It is said that one-fifth of all our coal is wasted by firemen. No estimates are available of the amount wasted by the public in the form of radiator heat and electric light, but the figures must be colossal and afford a tremendous opportunity for constructive action.

ONE of the things the present agitation for fuel economy has brought out is the wellnigh universal practice in this country of purposely overheating the interiors of buildings. One of the slogans of the national Fuel Administration is "Help Save 1,000,0000 Tons of Coal," by reducing the indoor temperature to 65° F. It looks as if a war is necessary to bring the American people to its senses in this matter.

POWER PLANT ENGINEERING



Measuring the Feed Water

One of the most forceful arguments of all which are advanced from time to time against the small building power plant is that these plants are costing more to operate than the large central stations controlled by the public service companies. To a certain extent this is undoubtedly true, owing to the fact that larger plants employ units ten, twenty or even one hundred times the size of those in the building plant, thereby obtaining an efficiency of apparatus and an economy in operating force absolutely impossible for the smaller installation.

But the cost per kilowatt to produce by the central station is far from being the total cost, for to this must be added the expense of distribution and the company's profit which is often based on a stock and bond issue of more or less hydraulic variety. Even the expense of distribution alone is in most cases sufficient to throw the cost in favor of the smaller plant which has no franchise to pay for, no rights of way to obtain and practically no distributing system either to install or to maintain.

One investigator has made the assertion that if the public service companies could produce current in their central stations for *nothing*, the cost of distribution would still make the electric rate higher than if the current were produced by a reasonably economical plant installed on the premises. But the plant *must* be reasonably economical! So, in spite of this advantage, incompetent engineers and lack of proper upkeep often combine to render the smaller plant more expensive.

To make the small plant economical and to insure its being kept so, some good, accurate method of checking its performance must be used. The owner or agent operating the installation will be much more inclined to keep a competent engineer on the job and to maintain the plant in proper operating condition if it is possible to show him, or, better yet, if he, himself, can see at once the increased cost per kilowatt, and the decreased production due to such causes. Further than this, the operating engineer can keep better posted on the plant operation, on the conditions in the boilers and the method of firing for the particular quality of coal being used than by any amount of inspection and criticism of the firemen.

RESULTS OBTAINED BY MEASURING FEED WATER.

The simplest method of checking up a power plant in regard to securing maximum efficiency is by the measurement of the feed water, and a prominent manufacturer sums up the results so obtained as follows:

(*a*) It determines the boiler efficiency: that is, the number of pounds of water evaporated per pound of coal and, therefore, the number of heat units secured per pound of coal burned.

(*b*) It determines which method of firing produces the best results with the grade of coal being burned.

(*c*) It determines which fireman employs the most efficient method of firing and which man it is, therefore, most desirable to retain on the force.

(*d*) It determines which grade of coal—in relation to its cost—is the most profitable for the plant to use.

(*e*) It shows up deterioration of the grates or leaks in the boiler settings as soon as these become sufficiently serious to affect the plant efficiency.

(*f*) It indicates the loss of efficiency when the tubes scale up or the heating surfaces are allowed to become covered with soot.

(*g*) It exercises a great moral influence on the operating force being an incentive to each to make the best showing possible, resulting in a plant being kept in the very finest operating condition at all times.

The most popular apparatus to serve the

purpose outlined above is that termed the "V-notch recorder." The accuracy of this device is claimed to be within ⅓ of 1%, a smaller amount of error than obtained by any other economical means.

The V-notch recorder, installed as an entirely separate piece of apparatus, is shown in Fig. 1. In this cut the boiler-feed pump—instead of taking its suction directly from the feed-water heater—takes the water from the suction chamber of the V-notch recorder apparatus, as indicated by the arrows. This lowers the water level in the suction chamber and causes the float in this chamber to drop. This float controls the flow of water entering the apparatus from the feed-water heater through a shaft and rod connection to the lever-handled valve on the pipe running from the feed-water heater to the recorder.

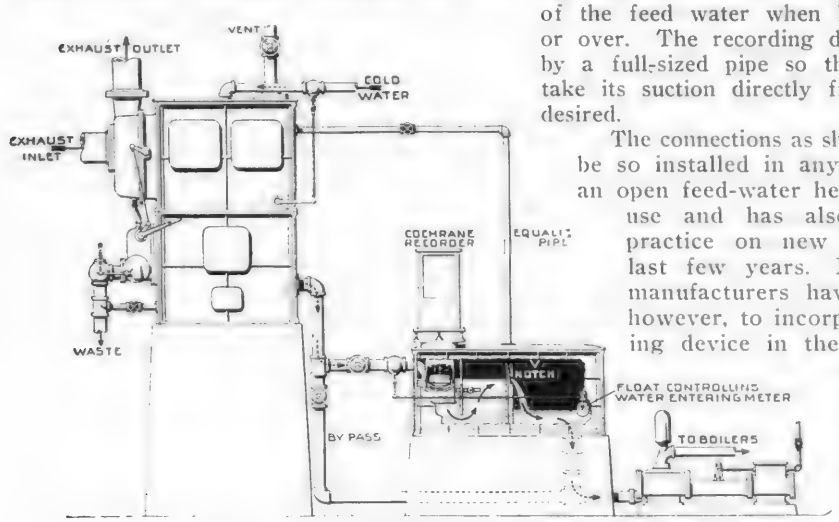


FIG. 1.—METHOD OF INSTALLING V-NOTCH METER IN CONNECTION WITH OPEN FEED-WATER HEATER.

The incoming water from the heater enters the inlet chamber of the recorder and flows under a baffle to the V-notch through which it spills into the pump suction chamber, previously described.

In the inlet chamber and enclosed within a hollow bottomless cylinder is placed a float which registers the height of the water on a clock-revolved time-chart in a manner similar to that employed to record steam pressures, temperatures, etc., by automatic recorders. This chart is graduated so that the area of the portion below the line marked thereon is transposable into the quantity of water, the height of the line being, of course, controlled by the height of the float and this in turn by the level of the water flowing through the V-notch.

The cold water coming into the system is admitted by the float in the feed-water heater just as usual and, in fact, no connections or piping are altered, as far as the heater is concerned, except the balance pipe which is run from the heater to the recording apparatus so as to prevent vaporizing of the feed water when heated to 212° F. or over. The recording device is by-passed by a full-sized pipe so that the pump can take its suction directly from the heater if desired.

The connections as shown in Fig. 1 may be so installed in any old plant where an open feed-water heater is already in use and has also been common practice on new plants until the last few years. Most open-heater manufacturers have now arranged, however, to incorporate the recording device in the heater construction itself. In such cases, the storage space in the bottom of the heater is utilized as the pump-suction chamber and the record float and recording device are installed in a little extension of the bottom portion of the heater somewhat as shown in Fig. 2, which is a view of the well-known Cochrane heater, so

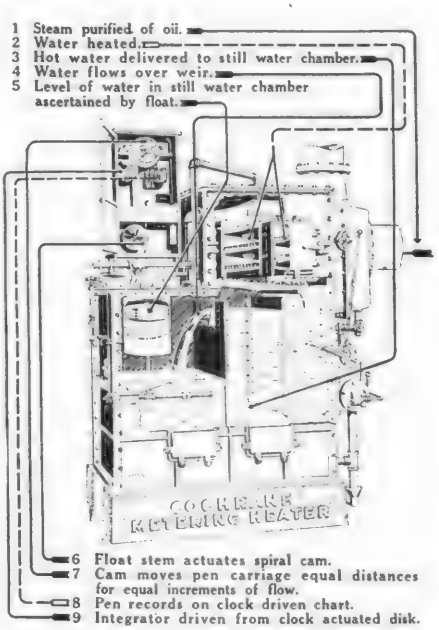

1 Steam purified of oil.
2 Water heated.
3 Hot water delivered to still water chamber.
4 Water flows over weir.
5 Level of water in still water chamber ascertained by float.
COCHRANE
6 Float stem actuates spiral cam.
7 Cam moves pen carriage equal distances for equal increments of flow.
8 Pen records on clock driven chart.
9 Integrator driven from clock actuated disk.

FIG. 2.—COCHRANE HEATER, ARRANGED WITH PUMP SUCTION CHAMBER IN BOTTOM OF HEATER.

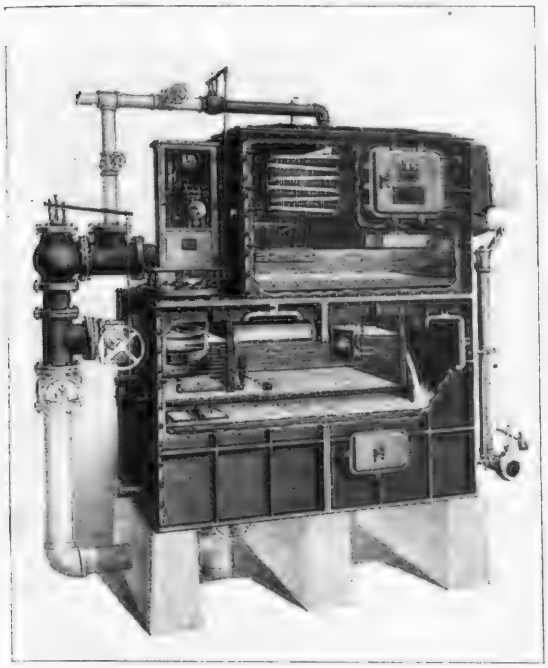


FIG. 3.—WEBSTER FEED-WATER HEATER.

arranged. The explanation of the separate apparatus will apply equally well to the combined equipment and the reader can readily trace the water flow by means of the arrows and notations on the cut.

The widely used Webster heater does not employ quite the same arrangement, as can be seen by reference to Fig. 3, the water in this heater passing downward continuously from the time of its entrance until it reaches the pump suction chamber at the bottom, but the principle is identical.

With a closed heater, the separate apparatus first described is again used, as shown in Fig. 4, and it will be noted that the make-up water in this case is controlled by a second and lower float in the pump-suction chamber; also that in Fig. 4 the feed-water goes to the closed heater last, instead of first, as in Fig. 1. This arrangement is not as common as those employing the open feed-water heater.

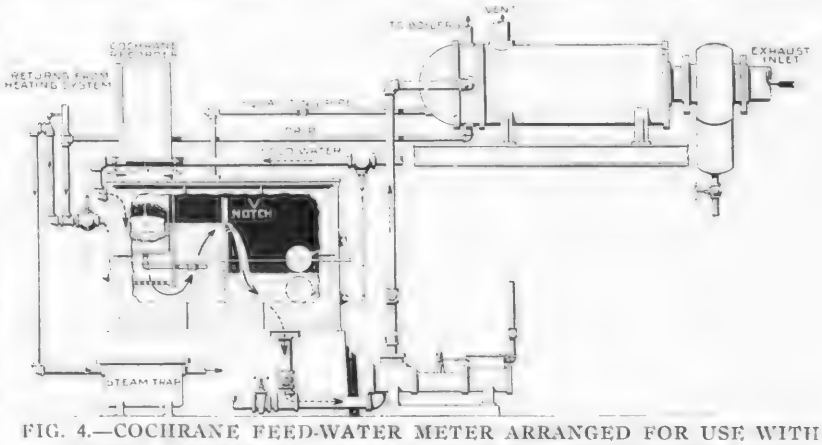
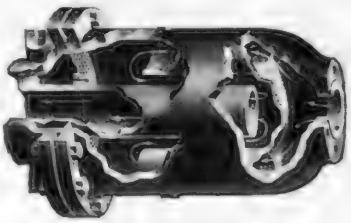


FIG. 4.—COCHRANE FEED-WATER METER ARRANGED FOR USE WITH CLOSED HEATER IN CONNECTION WITH EXHAUST STEAM HEATING SYSTEM.

NOTES

The Utility separator, made by the Standard Steam Specialty Co., New York, gives a storage capacity of steam at the throttle valve several times greater than the displacement



UTILITY STEAM SEPARATOR

of the piston. It is particularly desirable where the boiler and engine are separated by a considerable distance as it not only elminates the moisture in the steam but also catches all grit, scale, etc., which may be picked up by the steam in its passage through the piping system.

The cut illustrates the vertical type of this separator, but it is also built for horizontal and angular connections.

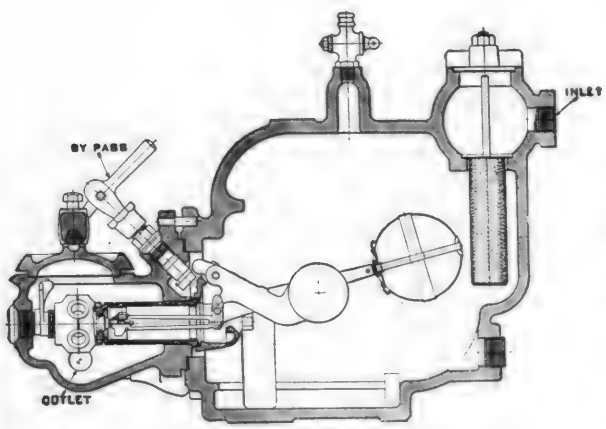
It is claimed that boilers troubled with scale—especially when caused by magnesia—will not only cease to form scale but will have gradually removed that already formed if a small amount of graphite is used with the feed water. The action on the magnesia in the water is to precipitate a mixture of magnesia and graphite in the form of a slime which may be easily washed out, while on the scale already formed the particles of graphite seem to work in between the scale and the steel, gradually loosening the scale as the treatment is kept up

In particularly bad cases the boiler should be inspected at the end of the first ten days and not less than every fifteen days thereafter for a couple of months. After that every thirty days will probably be sufficient.

The rising costs all along the line render the conservation of all materials most imperative. How many plants discharge their oily drips directly to the sewer? A very big percentage certainly! If this water is first passed through an oil-extracting tank a large percentage of the oil will be retained and can be re-filtered and re-used.

The extracting tank is a very simple proposition to build and can be cut into any oily trap discharge between the trap and the sewer. It consists simply of a tank large enough to insure a very slow velocity of flow through it and to serve as an oil recepter. Near the outlet end a baffle is placed, extending nearly to the bottom of the tank under which baffle the water flows to reach the outlet on the opposite side. Owing to the lighter specific gravity of the oil it will not sink and pass under the baffle to the outlet but instead is retained on the inlet side of the baffle and may be removed from time to time as fast as it collects in any quantity.

One of the well-known high and medium pressure drip traps on the market is the Anderson trap, made by the V. D. Anderson



ANDERSON PRESSURE DRIP TRAP.

Co., Cleveland, O. The interior construction is illustrated herewith. The trap is provided with a water gage, bypass, air valve, blowoff valve and sediment strainer.

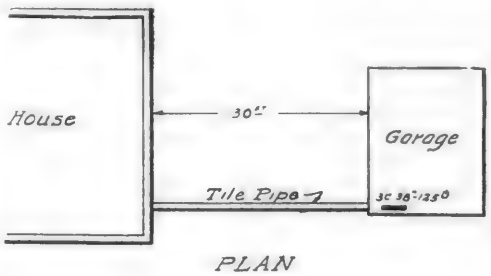
The "Model D" traps are made in five sizes to operate against any back pressure which is 5 lbs. less than the pressure at the inlet of the trap.

CORRESPONDENCE

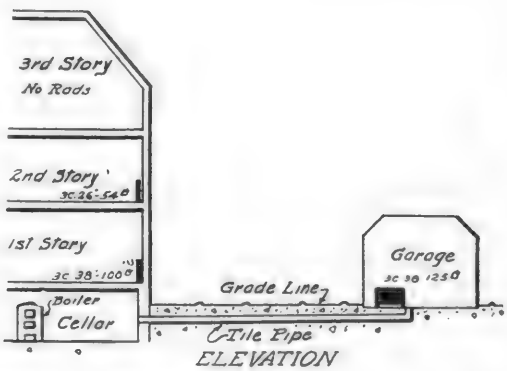
Hot Water Heating Connection to Garage.

EDITOR, HEATING AND VENTILATING MAGAZINE:

I desire to install a hot water heating system in a garage, and to supply it from the hot water system in the house. The garage stands approximately 30 ft. from the house and requires a radiator of 125 sq. ft. surface; I expect to run the circulation lines over to the garage and back, placing these lines in wrought-iron pipe, pitched up toward the garage.



PLAN



ELEVATION

FIG 1.—PROPOSED ARRANGEMENT FOR HEATING GARAGE.

The general conditions are indicated in the sketch of the plan and elevation accompanying this letter, the house being a three-story dwelling with no radiators on the third floor. The question on which I desire your help is whether you would run the hot water supply line to the third floor, then back down and across to the garage and, if so, would you put an air vent on the top of the loop? What kind of a vent would be most suitable? If not, would you run the supply up to the second floor radiator and then down and over to the garage?

Pittsburgh, Pa. H. W. A.

Our correspondent's sketch is shown in Fig. 1, except that the wrought-iron pipe he mentions has been changed to tile pipe which is much better for this sort of work. Both of his suggested schemes of circulation are good. It is a well-known fact that to circulate across a long, horizontal distance to another building some vertical rise is necessary in order to produce sufficient head to circulate the water.

If the line is carried up to the third floor level and then dropped back, as suggested by our correspondent, a high point is produced in which air will collect and this air must be gotten rid of from time to time to avoid its stopping the circulation. An air chamber about 12 in. or 18 in. high and of pipe two or three sizes larger than the circulation line may be used as a receiver for this air, and a common air valve mounted on the cap on top of the pipe will serve to relieve this accumulated air from time to time

This, of course, is not automatic in operation and the substitution of certain types of automatic air vents which "relieve air under pressure" might give better satisfaction As the difference in the weight of the two columns of water (in the pipe going up and the pipe going down) is dependent on the temperature difference and height, it follows that the pipe carried up to the third floor level will give better results than one only carried to the second floor and vented into the radiator On the other hand, the radiator furnishes an automatic method of ridding the loop of air and has an advantage in this respect

Our suggestion, however, would be to make the connections as shown in the sketch, Fig 2 While our correspondent does not specifically so state, we assume his house system is a gravity system with an expansion tank at some high point If this is the case, a small air relief pipe taken from the top of the loop and graded constantly up from the top of the loop to the point of its connection to the expansion pipe, just below the tank, will give the required air relief automatically without the use of any special devices This has been illustrated in Fig 2.

In case this arrangement is impossible, either on account of the use of a pressure system, or for other reasons, we recommend running the loop up to the third floor and venting, as before suggested.

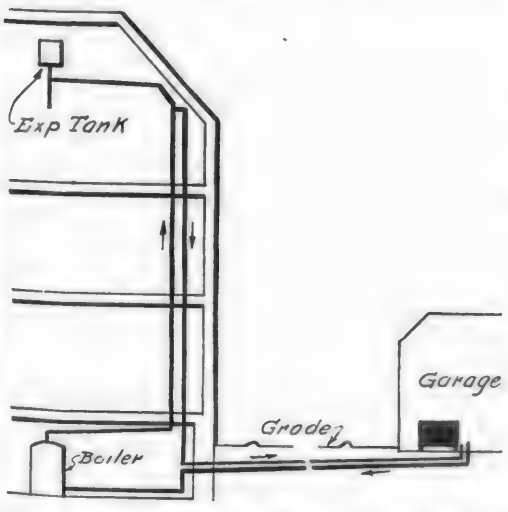


FIG 2.—SUGGESTED METHOD FOR HEATING GARAGE.

Formulas for Figuring Pipe Capacities.

EDITOR, HEATING AND VENTILATING MAGAZINE:

Will you kindly give me formulas for finding the quantity of air, water, and steam delivered per minute through a pipe, neglecting friction, when pressure and size of pipe is known.

Utica, N. Y. C. A. C.

The flow of water through pipes when the friction is neglected practically becomes the flow through an orifice of the same size and diameter as the pipe, since the pipe is only a continuation of the orifice for a definite or indefinite length. This is incorrect and impractical for pipe work, since even a short length of pipe will cut down the velocity and, therefore, the quantity flowing to a very large extent.

The only practical way of figuring pipe sizes without regard to friction is to assume a velocity in the pipe which will produce only a reasonable amount of friction, or drop in pressure, and then to compute for the area of the pipe, or vice versa. In such cases the formula used is

$$Q = \frac{AV}{144} \quad \text{or} \quad A = \frac{144Q}{V} \quad \text{or} \quad V = \frac{144Q}{A}$$

when Q = quantity delivered in cubic feet per minute
V = velocity of flow in feet per minute
A = area of pipe in square inches, or $0.7854\ D^2$ when
D = diameter of pipe in inches
144 = number of square inches in a square foot

Q for water is usually left in cubic feet or multiplied by 7.5 to transform it into gallons per minute.

Q for air is usually reduced from the

cubic feet per minute (at the pressure in the line) to pounds of air or to cubic feet of free air.

Q for steam is usually reduced from the cubic feet per minute (at the pressure maintained in the line as shown by steam tables) to pounds of steam per minute.

To apply the above, assuming an 8 in. pipe and 50 lbs. pressure with a velocity for water of 200 ft. per minute, of steam as 5,000 ft. per minute and of air as 5,000 ft. per minute, the deliveries are as follows:

The area in square inches of an 8-in. pipe = 50 (about)

For Water

$$Q = \frac{50 \times 200}{144} = \frac{10{,}000}{144} = 69.4 \text{ c.f.m.}$$

$69.4 \times 7.5 = 520$ gal. per minute.

For Steam

$$Q = \frac{50 \times 5{,}000}{144} = \frac{250{,}000}{144} = 1700 \text{ c.f.m. apx.}$$

Weight of 1 cu. ft. of steam at 50 lbs. gauge (see steam tables) = 0.15 lbs.

$1700 \times 0.15 = 255$ lbs. per minute.

For Air

The *cubic feet* per minute would be the same as for steam at the same velocity, but the weight of 1 cu. ft. of air at atmospheric pressure and 62° F., is 0.076 lbs. (See tables on "Properties of Air.") The temperature of the air (both at 50 lbs. pressure and atmosphere) remaining the same, the relative volumes may be computed from the formula:

$$P_1 V_1 = P_2 V_2$$

when P_1 and V_1 are the absolute *pressure* in pounds per square inch and *volume* in cubic feet in the first state and P_2 and V_2 the absolute pressure and volume in the second state.

Therefore, if the pipe delivers 1700 c.f.m. of air at 50 lbs. pressure, the volume of free air at the same temperature will be

$$P_1 V_1 = P_2 V_2$$

$$(50 + 14.7) \times 1700 = 14.7 \times V_2$$

$$\frac{64.7 \times 1700}{14.7} = V_2$$

$7500 = V_2$ or cubic feet of free air per minute and

$7500 \times 0.076 = 567$ lbs. of air per minute.

For the flow of steam, water and air through an orifice the correspondent is referred to the numerous formulæ and tables contained in Kent's Engineers Pocket Book.

The War and the Heating Engineer

Lower Indoor Temperatures as a War Conservation Measure.

Acting on the suggestion of Dr. Garfield, the fuel administrator of the country, that people reduce the temperature in their homes and offices a few degrees in order to reduce the heating requirements and thereby save a vast amount of coal, the Illinois Maintenance Company, of Chicago, acting for the Illinois State fuel administrator, has sent out a letter strongly seconding Dr. Garfield's suggestion. Accompanying the letter is a tag, reproduced herewith, to be placed on thermostats or above the radiator to act as a remainder.

The letter is substantially as follows:

The usual standard of temperature for homes and offices in this country has been from 68° to 70° F. A great many buildings exceed this temperature, and temperatures of 75°, 80° and 85° F. are not uncommon.

If people in Chicago would accustom themselves to an indoor temperature of 65° F., and maintain that tempeature by steady regulation of the steam supply there would be a saving of at least 15% of the fuel required for heating interiors, or a saving of about 1,000,000 tons of coal annually right here in Chicago.

Dr. E. Vernon Hill, chief of the Ventilating Division of the Chicago Health Department, says that the ordinary individual can easily become accustomed to this temperature, provided a sufficient amount of clothing is worn, as has been clearly

demonstrated by the experience of England, France and Canada, and by the general consensus of opinion of physicians and heating experts throughout the country.

Dr. W. A. Evans, formerly Health Commissioner of Chicago, and a well-known writer on such topics, states as follows:

Help Save
1,000,000
tons of coal
WHEN the room is sufficiently warm shut off the steam supply. The people in England and Canada have always maintained a standard heating temperature of 60 degrees Fahrenheit in their homes and offices as conducive to health. If all the people in Chicago would adopt 65 degrees Fahrenheit, it would save a million tons of coal annually, and thereby
Help Win The War
Do Your Bit

TAG SENT OUT BY ILLINOIS MAINTENANCE COMPANY.

> "Any number of experiments have shown that low temperatures, 60° to 68° F., as compared with the high temperatures which so often prevail in office buildings, school rooms and living places (70° to 85°) are favorable to health. For instance, a person staying for an hour in a warm room is certain to develop about a degree of fever. This leads to colds, infections generally, anemia, fatigue and general rundown conditions."

If Chicago will set the example, other cities will follow, and we will save not only 1,000,000 tons of coal here, but also several millions tons of coal throughout the country. This would conserve the coal for military purposes, and also bring down the cost, thus reducing the suffering among the poorer classes.

Will you not instruct the engineer to adjust the thermostats in your offices to not exceeding 65° F. so as to help along this movement and thus help win the war?

Store Savings in Fuel.

Four specific ways in which retail merchants can reduce the consumption of coal by economy in lighting are recommended by the Boston Chamber of Commerce.

1. Lights may be turned off at 8 p. m., or at the time of closing.
2. Electrical advertising signs may be discontinued.
3. The amount of heat, light, and power used in retail stores may be reduced by general effort.
4. Lights in show cases need not be turned on until 10 a. m.

General reductions of coal consumption may be effected by maintaining store heat at 65° F. or less, reducing the candlepower of electric lamps where a smaller lamp will answer every purpose, and replacement of old, blackened, current-wasting lamps whenever found.

The Watchman Evil.

The prevailing custom among manufacturers, warehousemen and others is to engage as night watchmen superannuated employees who are no longer able to earn a workman's pay. At the recent New Orleans convention of the Fire Marshals' Association of North America, it was voted to sound a warning to manufacturers and warehousemen that, especially in these times, watchmen should be picked men and not derelicts. They should also be sufficient in number to furnish real protection and they should be armed. They should receive special training for their important duties and this training should include knowledge of fire alarms, fire prevention and fire protection. They should never be engaged except upon unmistakable evidence of character, and they should be paid the salaries that will command such qualifications.

Paying for Liberty Bonds.

On November 15, which was the date on which the first installment on Liberty Loan Bonds was due, approximately $2,400,000,000 was paid in, although less than a third of that amount was due.

In other words, nearly two-thirds of the aggregate subscriptions to the Second Liberty Loan have been paid in full, the purchasers not availing themselves of the right to wait until December 15 and January 15 to make their other payments.

Growth of Federal Reserve System.

Between the dates, November 1 and November 16, 1917, State banks and trust

companies, whose aggregate total resources are $845,796,400, were admitted to the Federal Reserve System.

The Responsibility of Science for War Horrors.

"Unless some conscience is aroused that science is not to be used against man, but for him, then it will never be safe for this world," said Dr. Ira N. Hollis, retiring president of the mechanical engineers' society in his recent presidential address. "It is our task," continued Dr. Hollis, "to assist in making the world safe against the forces that we have unloosened, so that the century may not close with a total failure of the civilization of Christian races. It is we who have developed the application of science, and it is we who are using it to destroy one another, forced into the struggle by the rulers of a nation that knows no right except might, and no mercy except that which is taught them by the sword.

"The twentieth century is still young, and we do not yet know what it will represent to the future historian. Will it be the debauch of science or will it mean a new birth to Christianity? It is the engineers' task to decide this. There are two tendencies; one toward greater comfort and luxury, and one towards greater service. The first can plunge us only deeper and deeper into war for the control of a commercial output. It can only bring us more firmly under a governing class devised either by birth or by commercial success. The second means the complete emancipation of the individual trained to think of service as the chief source of good government and happiness in life. The only theory that will hold men together is that of service."

Engineers Serving Government in War.

How the 30,000 engineers represented in the great technical societies of this country are quietly serving the government in performing all manner of duties—confidential and otherwise, was disclosed at the convention of The American Society of Mechanical Engineers by Gano Dunn, chairman of the Engineering Committee of the Council of National Defense. Mr. Dunn said the government had made numerous and various calls upon engineers for service, and there is not yet on record a single case in which the government has asked an engineer to perform a service and the service has not been promptly and faithfully rendered.

Mr. Dunn related how at the outset of our war the Government soon used up its own resources of professional men and fell back upon those of the great technical societies which responded patriotically to their new duties and opportunities. He said that the United States is not really in the war yet and he expected the time to come shortly when all the engineers of the nation would be needed for service. He said the engineers stood ready to respond, even as numbers have already responded by severing all their business connections and sacrificing their incomes.

Preparations for the Third Liberty Loan.

According to present estimates, the third Liberty Loan will be undertaken the middle of February or the first of March. The amount of money to be raised is much greater than was raised in both of the previous loans and the call upon the country's resources and upon every citizen will be greater than ever.

In an effort to promote thrift and self-denial in this country at the present time, it is authoritatively stated that our war bills, growing heavier as the climax of the world contest draws nearer, cannot be met by the same measure of thrift that characterized the first months. The United States must reach and surpass the mark set in France and Great Britain. In England, one bank alone, the London City and Midland, reports that its depositors applied for $451,198,000 of the last war loan, or considerably more than one-half the amount standing to their credit. This may give an insight into the compelling pressure of patriotism upon all classes of persons in England, for the London City and Midland reaches all social ranks. It must not be supposed that these English subscribers drew all their half-billion from the bank in order to pay for their bonds. Such a step would have resulted in grave trouble. This tremendous total could not have been lent to the Government without the most extraordinary thrift and self-denial.

Organization of Central War Industries Committee.

One of the principal actions taken at the recent conference of the Chamber of Commerce of the United States, held in Washington, December 12, was the creation of a central war industries committee of the National Chamber, with Waddill Catchings

as chairman. The convention voted that where there are at present war service committees they be requested to ask recognition of the war committee of the National Chamber and it was provided that if they are organized in conformity with this report, that they be so recognized.

All existing national trade organizations or associations which have not already appointed war service committees are requested to do so immediately. All such war service committees are to be vested with authority to represent the industries in their relations with the government during the war. In this way a close touch will be maintained with producers in the various lines, with data on individual concerns that are able to carry out the necessary contracts. The war service committees are also to act as clearing houses as to available plant capacity, notifying the government of the facts ascertained in order that needless expenditures for additional plants and equipment may be avoided.

The Boiler and Radiator Manufacturers' Association met in New York December 10, to appoint a war committee to represent this industry.

New Food-Saving Suggestions.

To the wheatless and meatless days has been added a porkless day and to each day a wheatless and a meatless meal. The consumer is urged to use sugar on the basis of 3 lbs. per person per month. As a nation, states the Food Administration, we eat and waste 80% more protein than we require to maintain health and, therefore, we can reduce the amount of meat we eat without harm. We eat and waste 240% more fat than is necessary. New home food cards have been issued by the Food Administration, containing these additional suggestions.

On the reverse side of the card it is stated that "the food situation in Europe is far graver than when the preliminary survey of the food supply of the world for 1917 was made. We have an abundance for ourselves, but food has now taken a dominant position in the war and the American people are asked to sacrifice far more than was at first thought necessary. All of the surplus wheat from the 1917 harvest has already been exported, so that any additional wheat or its products that the allies receive from the United States from now on will be exactly the amount which our people have saved each month.

War-Savings Certificates.

Attention is called in a new Treasury Department circular (No. 94) to the war-savings certificates, series of 1918, which were recently placed on the market. The sum of certificates outstanding at any one time is limited to $2,000,000,000, while the amount sold to any one person at any one time is limited at $1,000. This is done to secure as wide a distribution as possible. As is generally known, each certificate has spaces for 20 war-savings stamps, each of which will have a maturity value of $5.00 on January 1, 1923, making the value of the certificate at that time, when filled with stamps, $100.00.

The prices of the stamps range from $4.12 in Januay, 1918, to $4.23 in December, 1918, so that the average issue price fixed for the year 1918, with interest compounded quarterly, will amount to $5.00 in January, 1923.

As an easy method of saving money for the purchase of war-savings certificate stamps, the government has issued thrift stamps, having a face value of 25 cents. These are to be affixed to Thrift Cards, both being obtained from the post-office, bank or other agency. When sixteen Thrift Stamps have been affixed, the card may be exchanged for a war-savings certificate stamp by the payment of a small exchange, all of which has been carefully figured to give the purchaser 4% compound interest on his investment.

Old Tracings for Bandages.

The use of old tracings for bandages has proved so successful that the Red Cross has asked its 3,000 chapters throughout the United States to co-operate in the work. Tracing cloth is a very fine quality of linen and is easily made available for bandages by putting it through a laundry. Business concerns with drafting offices are asked to gather up their discarded tracings and send them to the nearest Red Cross branch.

Heating Men in Military Service.

Captain C. L. Collette, formerly with the Kewanee Boiler Co., has recently been awarded special honors for marksmanship at Camp Grant, Rockford, Ill.

John B. Thomson, architect, and Norman B. Thomson, a senior in Penn State College,

both sons of T. N. Thomson, of Scranton, Pa., have enlisted in the aviation corps and are in training at Fort Sam Houston, Texas.

A. W. Mills, formerly western representative of the Haydenville Co., Haydenville, Mass., has been commissioned an ensign in the merchant marine. He has charge of the guns and gunners on one of the armed merchant vessels.

Allen B. Stiles, of Crane Co., Chicago, has been commissioned a lieutenant of artillery in the National Army. He is at present acting as aide to Brigadier-General Henn.

C. C. Vaughn, president of the Lytton Mfg. Corporation, Franklin, Va., has been commissioned a brigadier-general in command of the Virginia State troops. General Vaughan served as captain of militia in the Spanish-American War and at the opening of the present war was brigadier-general of the Virginia volunteers. He comes from a family of soldiers, his father having served in the Confederate Army throughout the Civil War, while direct ancestors of General Vaughan served in the War of 1812 and in the Revolutionary War. His son, Cecil C. Vaughan III, is a first lieutenant of the Virginia troops.

New York Steam Company's Rates Reviewed by Public Service Commission.

In a recently-instituted rate proceeding, the New York Public Service Commission for the First District, has undertaken, among other things, to determine the question of the effect of the New York Steam Company's new schedule which was filed with the commission on 30 days' notice and which became effective June 1, 1917, on unexpired term contracts.

According to this schedule the company renders its service under five rates: Rate A, for general service; Rate B, for annual power service; Rate C, for apartment house service; Rate D, for summer power service; and Rate E, for auxiliary or emergency heating service. In all of these rates the unit of heat is a kal, which is 1 lb. of water evaporated into steam or 1 lb. of steam condensed into water.

The rate for general service (Rate A) for the first 20,000 kals consumed in each monthly period is $1.50 per 1000 kals; for annual power service (Rate B) for the first 500,000 kals consumed in each monthly period, $0.60 per 1000 kals; for apartment house service (Rate C) $0.60 per 1000 kals for all steam condensed, with a minimum of 100,000 kals; for summer power service (Rate D) for the first 500,000 kals consumed in each monthly period, $0.55 per 1000 kals; and for auxiliary or emergency heating service (Rate E) for the first 20,000 kals consumed in each monthly period, $1.50 per 1000 kals. All of these rates, except in the case of apartment house service, are subject to the usual reductions for increased steam consumption.

The principal matter that came before the commission for determination was the effect of the company's new schedule on service contracts which had not expired at the time the schedule went into effect. Most of the customers holding these unexpired contracts became convinced that they were abrogated by the new schedule, but one customer appealed to the commission.

He was informed by the secretary of the commission that the company's new schedule "is the lawful charge for service from the date it became effective," but "it is not considered that it gives the steam company the right to abrogate term contracts. Where the commission, after an inquiry and a determination, by order, fixes a rate it has held that the rate so fixed has the effect of abrogating term contracts, but in the case under discussion the rate is that filed by the company on its own motion."

In a memorandum prepared by the steam company it is pointed out that the case is not one of first impression, as "the law was well settled ten years ago in Armour Packing Co. v. United States, (209 U. S. 56) and the rule laid down in that case has since been iterated and reiterated by the courts."

The point is also made in the memorandum that the hearing is futile because the commission has no power to make any order directing the steam company to perform unexpired contracts. Arguments are also made to prove that a schedule filed voluntarily by a public service corporation has, for all purposes, the same force and effect as a schedule filed under an order of the commission prescribing its terms.

It is further pointed out that the authorities are uniform that all service contracts of a public utility are made subject to a lawful change in the rate, although that change may have been voluntarily effected by the utility itself.

In conclusion, the New York Steam Company asks that the supplementary proceeding be dismissed and that the opinion expressed by the secretary repudiated.

The commission's decision and opinion are being awaited.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Preparations for Annual Meeting.

Two evening sessions, in addition to the daily sessions, have been arranged for the annual meeting of The American Society of Heating and Ventilating Engineers, to be held at the Engineering Societies Building, New York, January 22-24. Following is the schedule:

TUESDAY, JANUARY 22.

Business session, 2 p. m.
Drying session, 8 p. m.

WEDNESDAY, JANUARY 23.

Fuel Conservation session, 2 p. m.
Hearing on Boiler Testing Code, 8 p. m.

THURSDAY, JANUARY 24.

Furnace session, 10 a. m.
General professional session, 2 p. m.
Annual dinner, 7 p. m.

A joint committee of the society and of the New York Chapter will have charge of the social features of the society's forthcoming annual meeting, to be held January 22-24, in the Engineering Societies Building, New York. This committee is headed by R. W. Pryor, Jr. The chairman of the various sub-committees are: Finance, P. H. Seward; information bureau, H. G. Issertell; ladies, W. H. Driscoll; dinner, B. H. Strader.

Arrangements have been made to hold the annual dinner of the society in the Belvidere Room of the Hotel Astor on the last evening of the meeting, January 24, instead of on the second evening.

New Chapter Organized in Minnesota.

A new chapter of the American Society of Heating and Ventilating Engineers has been organized in Minneapolis, Minn., to be known as the Minnesota Chapter. At a meeting, held at the Minneapolis Athletic Club, a preliminary organization was effected by the election of Professor John R. Allen as temporary chairman and Harry E. Gerrish as temporary secretary. Those present at the meeting were Prof. John R. Allen, Charles L. Pillsbury, Albert Martin, Donald Forfar, Glenn C. Morgan, Robert Otto, George Atherton, Hans J. Meyer and Harry E. Gerrish.

It was decided to appoint a committee to draw up a constitution and by-laws and to compile a list of prospective members to strengthen the petition to be forwarded later to headquarters for a chapter charter. It was estimated that the membership in Minneapolis and vicinity could be increased 300% to 400%.

At a subsequent meeting held December 7, with the local chapter of the American Institute of Electrical Engineers, the subject of central station was taken up, the discussion being opened by Professor Allen.

New York Chapter Given Data on High-Temperature Drying.

A notable review of the development of high-temperature drying and of the possibilities in this direction was given in an address delivered by Burt S. Harrison, at the December meeting of the New York Chapter. The meeting which was held at the Building Trades Club, New York, December 17, was in charge of a committee headed by W. F. Goodnow.

Mr. Harrison read from a carefully-prepared manuscript which proved to be full of practical notes on the subject gleaned from a long experience in many lines of drying work. At the conclusion of his address it was voted unanimously to turn over the paper to the society with a view to having it presented at the annual meeting or at least published in the society's Journal.

One of the points brought out by Mr. Harrison was that such foods as potatoes are apt to turn dark on being dried and while this does not harm them as a food, they do not present so palatable an appearance, with the result that in commercial practice they are often adulterated with a bleaching agent, containing sulphuric acid, which is distinctly injurious to health. He said more pure food laws were needed to make the field successful for wholesome dried fruits and vegetables.

He also spoke of the difficulties encountered when manufacturers change the conditions in connection with the drying of their products after the preliminary tests are made and in some cases, the apparatus installed.

The presence of static electricity in the hot air is an important matter frequently resulting in charging fabrics and gums. Ozonized air is of little avail in this connection and electric conductors are too expensive.

Air at high temperatures has high transmission losses, running as high as 3 B.T.U.

per square foot per degree difference and for this reason it is advisable to use trunk lines of ducts, as far as possible, and to take off the branches at one point.

In making the joints of an air-tube heater tight, Mr. Harrison said the best combination was a mixture of Portland cement and buttermilk. He advocated the use of steel-plate fans for drying work in preference to multi-blade fans, a statement that was endorsed in the ensuing discussion by J. I. Lyle.

The best fuel for use with air-tube heaters, he found, was a high grade of crude oil.

In response to a question Mr. Harrison stated that he did not consider that the small, individual drying units for household use would go very far in nationalizing the dried food industry. While these units are capable of drying the various products, their preservation is another matter and unless they are dried under the proper conditions they are subject to mold and other troubles. In his opinion the only way to dry foods successfully on a national scale is to establish central drying plants to be operated by experts where the farmers may bring their produce.

Previous to Mr. Harrison's address H. G. Issertell, acting as a member of the national Red Cross committee, made a plea for the support of the members in the drive for 10,000,000 members by Christmas Eve. Forty members and guests were present.

Professor John R. Allen Addresses Illinois Chapter.

"What We Do and What We Don't Know About Heating" was told by Professor J. R. Allen at the December meeting of the Illinois Chapter, held at the Engineers' Club, Chicago, December 10. Professor Allen, who is now dean of the College of Engineering and Architecture at the University of Minnesota, brought greetings from the Minnesota Chapter of the society, which has just been formed. He then spoke at length on the subject of heating constants, basing his remarks largely on the tests that have been conducted at the University of Michigan for heat losses through a specially-constructed testing room which was subjected to a variety of conditions of wind and rain (see THE HEATING AND VENTILATING MAGAZINE for August, 1916). As a result of these experiments, he said, he is now using a constant of 1.25 for glass.

"We need in this country," said Professor Allen, "a vast amount of experimental research so as to place these fundamental constants of the heating business on a well-established foundation." He believed, however, that it will never be possible in heating work to entirely eliminate the factor of judgment, due to the many variables entering the problem, such as the conditions of building construction, and materials used.

Kansas City Chapter Discusses Wind Leakage and Domestic Water Heating.

Addresses by H. W. Whitten on "Wind Leakage and Its Effect on Heating and Ventilation" and by W. W. Howe on "Heating Hot Water for Domestic Purposes" were presented at the December meeting of the Kansas City Chapter, which was held December 7 at the University Club. In the absence of W. N. McIntyre, chairman for this meeting, the subject of wind leakage was handled by H. W. Whitten. So much valuable information was contained in Mr. Whitten's talk that it was voted to have the data compiled by a special committee, consisting of R. F. Taylor and W. W. Downes.

Some of the points brought out by Mr. Whitten were as follows:

The average window or door has a free opening around its sides directly connected with outdoors and about 20 ft. in length. The width of this opening is usually such that its total area is about the size of a brick. In other words, each window or door is equivalent to a hole the size of a brick or shingle, leading directly outdoors. When there is no wind, this condition is not so serious, but when the wind blows, the effect is as follows:

Heretofore people have assumed that it was necessary to thus protect the north side only, but exhaustive tests have shown, with a wind from the north, that on the leeward or south side of the house, a suction was created, thus causing an outflow of heat through the cracks in the windows and a corresponding heat loss, due to outflow or loss of warm air going out. Air leakage, therefore, is due to inflow of cold air from the window pressure and outflow on leeward side, due to a partial vacuum and air expansion. Both have a corresponding effect on the loss of heat, and this shows the fallacy of weatherstripping only part of the house.

Warm air expands in all directions and the expansion of warmed air in the building will keep out most of the cold drafts until the wind rises above six miles per hour. On the other hand, the wind blowing around and over a building causes a suction

or partial vacuum on the sheltered sides of the building, and this suction pulls on every open crack. The inside air, warmed and expanded, is trying to escape, just as it would from a hot air balloon, and is assisted by the suction action of the outside wind, the result being that the heat loss on the sheltered side, window for window and door for door, will be about 20% greater than the loss on the exposed side, due to the suction above mentioned. Effective weather-stripping will practically eliminate this loss.

In addition to the regular programme P. W. Thomas, fuel engineer, of the Central Coal & Coke Company, presented suggestions for fuel conservation. The coal situation, he said, has become almost a national crisis. Kansas City proper is well taken care of in the matter of coal supply because of early storage in the yards, but the Southwest as a whole is not so fortunate. Kansas City users of coal should be careful of heating plants, not so much because of conditions in the city as because the tonnage saved there means that the smaller towns in Kansas, Missouri and Nebraska will get coal. Even cities such as St. Paul, Minneapolis and St. Louis and Chicago are begging for coal from the Arkansas field.

In the Kansas City section of the country, a simple method of conservation is to order Arkansas semi-anthracite lump to mine-run grades: The mine-run, said Mr. Thomas, is a good domestic fuel, practically equal to the lump in heating power and lower in price. It carries an additional appeal in that every ton produced at the mine goes into the domestic trade. For every ton of screened or forked lump coal that Kansas City burns, some steam plant consumes three tons of the same coal. This is not because the mine-run is 75% slack—but because the lump coal cannot be handled without breakage. Accordingly, of 100 tons screened at the mine, fifty tons of lump may be shipped to Kansas City, the other fifty tons being shipped as slack to a steam plant. The fifty tons of lump, arriving here, is so broken by transportation that, on being forked, twenty-five tons more fine coal of the same heating power as lump, for it is crushed lumps, is thrown to the steam trade, leaving twenty-five tons of the original 100 as lump.

The ironical condition is that this lump, after being dropped into the basement of the purchaser, is again reduced to half lump, half slack, by picks and hammers. In other words, many users of coal are paying for lump, receiving it, and after causing a shortage of three tons of coal to the domestic trade, are taking a sledge, pick or hammer and reducing this lump to a grade that they could have bought direct at a lower price.

British Institution of Heating Engineers.

At the autumn meeting of the Institution of Heating and Ventilating Engineers, held in London, October 9, Edgar Herring, of London, was elected president, to succeed Sam Naylor. F. Biggin, of Sheffield, was elected vice-president.

The principal paper presented at the meeting was on "Temperature Records under varying Climatic Conditions," by Walter Jones. This paper described some experiments which had been made by Mr. Jones in his own residence and in two of his business offices. Records were made of the outdoor and indoor temperatures at regular intervals and of the fluctuations of the temperature of the hot water used in the heating systems. As a general rule in the house tests, it was found that for each degree drop in temperature outside, an increase of 2° F. in the water temperature was sufficient to keep up the room temperatures. It was also shown that the lowest water temperature recorded, 100° F., and the highest, 160°, proved that the boiler capacity and the amount of radiation were sufficient.

A report of the progress of the research work at University College was presented by A. H. Barker, illustrated by lantern slides, showing many of the methods adopted and the delicate appliances which had been installed. Mr. Barker asked the members to further the movement to raise the necessary funds so that the institution could obtain the proposed Government grant of £450 for research work.

The annual general meeting of the institution will be held in London, February 12.

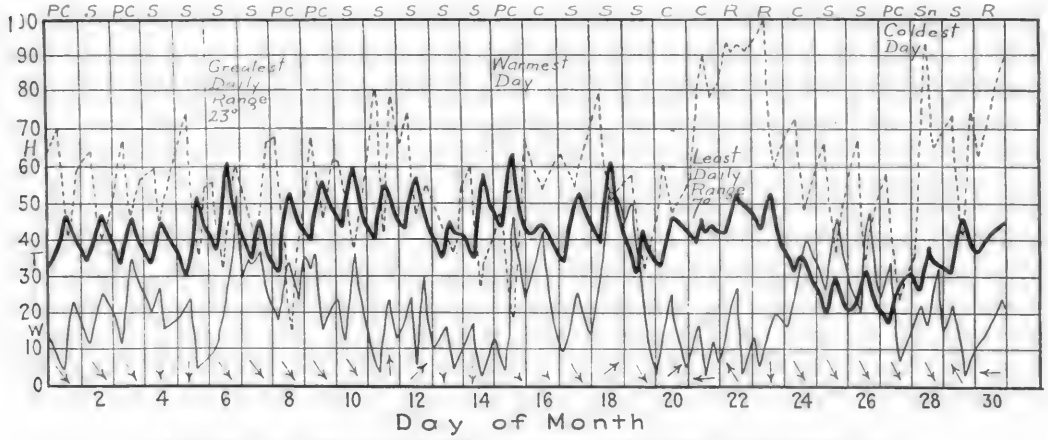
Annual Meeting of American Society of Mechanical Engineers.

War topics predominated at the recent annual meeting of the American Society of Mechanical Engineers, which was held in New York, December 4-7, 1917. Methods were also considered whereby the problem of fuel conservation will be met, either by compelling coal consumers to execute such measures of economy as the authorities prescribe, or else by disseminating correct information regarding the mining and consumption of coal, accompanied by an appeal to the patriotism of consumers.

Charles T. Main, of Boston, a consulting engineer, was elected president of the society.

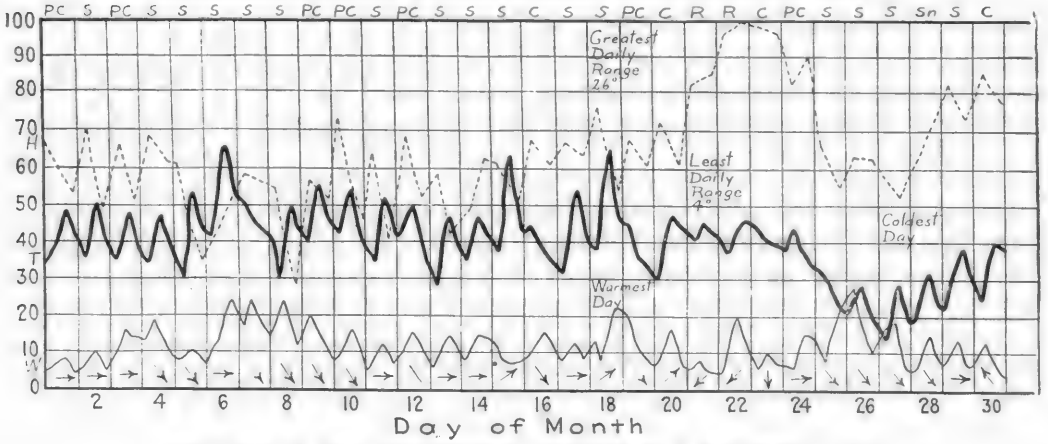
The Weather for November, 1917

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F	63	65	64	69	74
Date of highest temperature	15	18	6	17	7
Lowest temperature, degrees F	18	13	19	22	24
Date of lowest temperature	27	27	25	24	24
Greatest daily range, degrees F	23	26	28	23	32
Date of greatest daily range	6	18	9	15	3
Least daily range, degrees F	7	4	4	3	3
Date of least daily range	21	21	28	28	28
Mean temp. for month, degrees F	41.2	39	40	43.1	47.4
Normal mean temp. for month, degrees F	44	41.2	42.9	39.2	43.4
Total rainfall, in	0.68	0.59	0.28	0.56	0.78
Total snowfall, in	0.3	2.2	1.0	1.5	
Normal precipitation, this month, in	3.44	4.1	2.55	2.5	2.88
Total wind movement, miles	15519	7836	6438	7728	7427
Average hourly wind velocity, miles	17.4	10.9	8.9	10.7	10.3
Prevailing direction of wind	N.W.	N. W.	N.W.	N.W.	N.W.
Number of clear days	16	16	9	12	11
Number of partly cloudy days	7	7	8	4	6
Number of cloudy days	7	7	13	13	13
Number of days on which rain fell	4	2	4	1	5
Number of days on which snow fell	1	1	2	4	None
Snow on ground at end of month, in	None	Trace	None	None	None

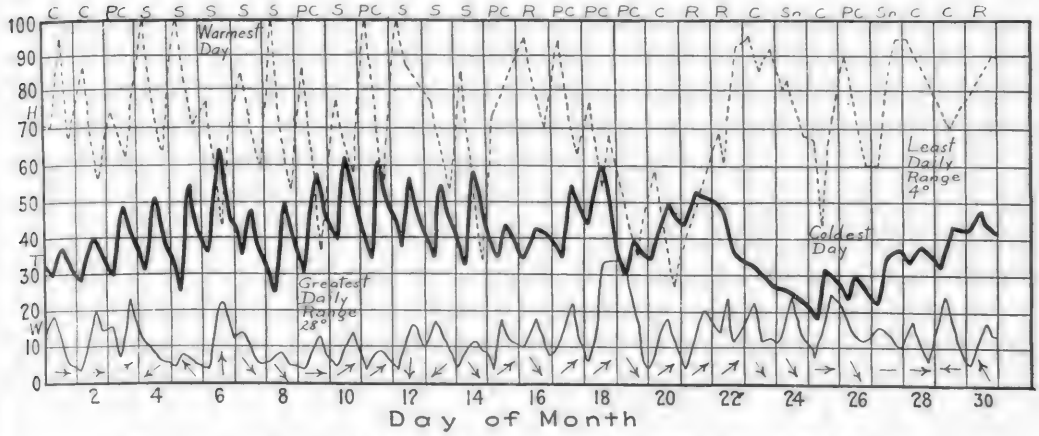


RECORD OF THE WEATHER IN NEW YORK FOR NOVEMBER, 1917.

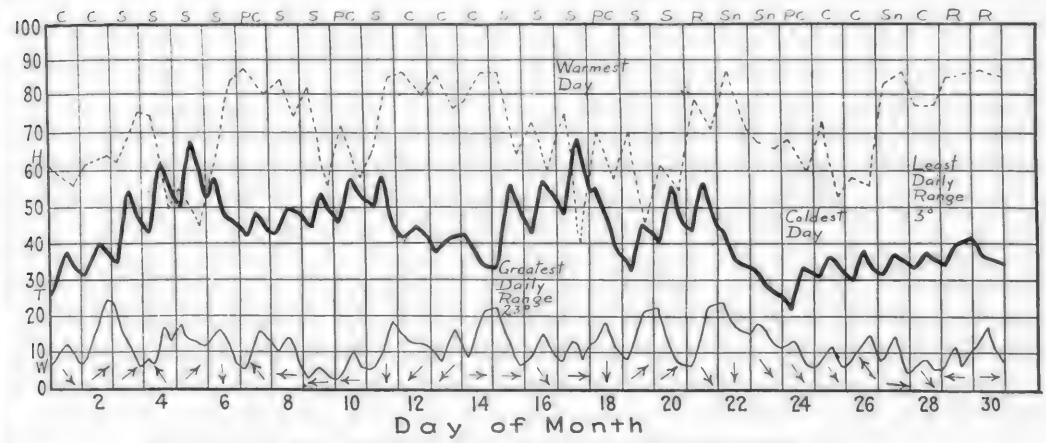
(Hourly observations of the relative humidity are recorded on this chart.)



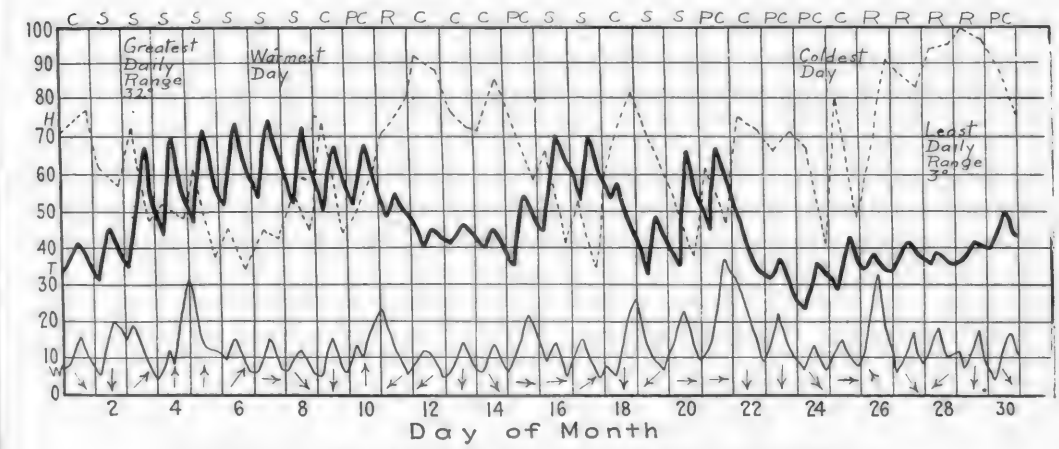
RECORD OF THE WEATHER IN BOSTON FOR NOVEMBER, 1917.


C C Pc S S S S S Pc S Pc S S S Pc R Pc Pc Pc C R R C Sn C Pc Sn C C R
Warmest Day
Least Daily Range 4°
Coldest Day
Greatest Daily Range 28°
H
T
W
Day of Month

RECORD OF THE WEATHER IN PITTSBURGH FOR NOVEMBER, 1917.
(Relative humidity observations taken at 8 a. m., noon and 8 p. m.)


C C S S S S Pc S S Pc S C C C S S S Pc S S R Sn Sn Pc C C Sn C R R
Warmest Day
Least Daily Range 3°
Coldest Day
Greatest Daily Range 23°
H
T
W
Day of Month

RECORD OF THE WEATHER IN CHICAGO FOR NOVEMBER, 1917.


C S S S S S S S C Pc R C C C Pc S S C S S Pc C Pc Pc C R R R R Pc
Greatest Daily Range 32°
Warmest Day
Coldest Day
Least Daily Range 3°
H
T
W
Day of Month

RECORD OF THE WEATHER IN ST. LOUIS FOR NOVEMBER, 1917.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

How the Contractors Saved the Day at Camp Upton.

All accounts agree that nothing more strenuous has ever happened in American commercial life than the work of constructing and equipping the great army cantonments within the time limits prescribed by the government. From all sides come tales of almost insuperable difficulties met and overcome, although the exertions necessary to put things through were often nerve-racking in the extreme.

Camp Upton, at Yaphank, L. I., N. Y., was no exception to the rule. The contract for the equipment of this cantonment was in the hands of the Thompson-Starrett Co., of New York. The installation was in direct charge of W. H. Driscoll, head of the heating department of that company. So important was the undertaking that the matter of working hours for those in charge was a thing not to be thought of. The working day consisted of the necessary time to get things done even if it took all the time there was, day and night.

A typical instance of the kinds of problems that were constantly confronting the contractors was told by Mr. Driscoll at a recent meeting of the New York Chapter of the Heating engineers' society. The contractor at Camp Upton had promised the constructing quartermaster that the pumping station would be put in operation on Sunday, September 1, and that water would be pumped into the mains on that date. To fulfill this promise it was necessary to maintain a force of workmen constantly at full efficiency so that absolutely accurate measurements of connecting parts could be determined in advance; that these parts be manufactured, delivered and assembled on schedule time and that there be absolutely no slip in any part of the program.

The problem confronting the contractor may be better understood when it is realized that the manufacture of the various parts would ordinarily consume from three to four months, whereas, the work had to be done in less than three weeks. By almost super-human effort most of the material was manufactured and delivered to the job and assembling of same was well under way by Friday, August 30.

The vacuum pumps, however, had been lost in transit as well as the disconnecting switches which were to be erected on the poles outside the pumping station. Inspectors were working day and night tracing these shipments, while, at the same time, efforts were being made to duplicate the materials required. Telegrams were sent out to the various manufacturers in an effort to secure duplicate apparatus. Representatives were sent to the factories near New York in an effort to beg, or borrow the required materials.

On Saturday morning, August 31, enough material was gotten together in one of the factories to make up the disconnecting switches. These were packed in a box and the contractor's representative had them trucked to the railroad station. The box was about as large as two ordinary trunks and weighed 350 lbs., and could by no stretch of the imagination be considered as baggage. Under the ordinary rules of the road there were only two ways to ship it; one was by express and the other by freight, but shipment either way meant that the goods could not possibly have been delivered before Monday or Tuesday.

The only way to get the material to the job on time was to persuade the railroad agent that the material in the box was personal baggage and entitled to transportation as such. The agent called attention to the fact that if it were personal baggage, the box would have handles on it, but this little difficulty was remedied by the contractor's representative who purchased a piece of rope and nailed rope handles on either end.

After much persuasion, at about the time the train for New York was pulling in, the agent accepted the material but in attempting to have it put on the baggage car, it was turned down again.

Another argument ensued but the box was finally accepted and started for New York under the watchful eye of the contractor's representative. By telegraphing ahead, arrangements were made so that when the train pulled into New York at six o'clock, Saturday, an auto truck was backed up to the railroad station and the box promptly transferred to same. The chauffeur was instructed to break all the speed records to Yaphank, which he did, and at eleven o'clock at night be delivered the goods to the pumping station. The electricians by working all night on the poles had the connecting switches erected in place by Sunday morning.

The vacuum pumps, however, had not arrived on the job nor had it been possible to locate duplicate pumps and unless a vacuum could be created in the suction line to draw the water out of the wells, and properly prime the pumps, all previous effort would have been wasted—insofar as the fulfillment of the promise was concerned. Fortunately, however, there arrived at the camp that day a small air compressor which was intended to be used in connection with the fire whistle. This compressor was

picked up in the camp and rushed by auto truck to the pumping station. Here the suction side of the compressor was hooked up to the vacuum chamber and, although it imposed a load on the little compressor that it was never intended to carry, it responded nobly and, after much effort, succeeded in creating sufficient vacuum to raise the water from the wells and prime the pumps and at 1:30 o'clock the pumps were put in operation and the water turned into the mains in accordance with previous promise.

A Heating, Plumbing and Tinning Cost Book.

A cost book that takes in all the important items for heating, plumbing and tinning work, has recently been published by Richards & Roberts, Stamford, Conn., under the title of the R & R Plumbing, Heating and Tinning Cost Book. The book is made up of a series of tables, all thumb-indexed with red leather tags, the whole making a very presentable and convenient volume. The materials listed are brass bibs, brass fittings (rough and finished), brass gate valves, brass pipe, cast-iron fittings, covering, drainage fittings, expansion tanks and range boilers, galvanized fittings, galvanized iron, gate and check valves, lead traps and bends, leaders and gutters, pipe, pipe hangers, radiator valves, boilers (round and square), soil pipe soil fittings and price sheet.

The book is prefaced with an interesting table for determining a single net discount for any group of discounts. There is also at the back a price sheet for entering the current prices of all the materials listed.

Considerable ingenuity has been shown in the preparation of the tables which are simply arranged so as to be clear at a moment's glance. The data should be very useful to all who are engaged in this line of work.

The cost book sells for $13.00 bound in leather and for $10.00 bound in cloth. The leather covers are limp, so that the book may be readily folded. Size 9½ x 11¼ in., with 37 tables.

New Publications.

PROCEEDINGS OF THE NATIONAL DISTRICT HEATING ASSOCIATION for 1917, have been published by Secretary D. L. Gaskill, Greenville, O., in a volume containing 371 pages. A complete transcript is given of the papers and reports presented at the association's meeting in Detroit, June 12-15, together with the discussions. The volume also contains the new officers and committees, a revised membership list, the revised constitution and by-laws. In connection with the report of the heating research committee, the entire data compiled by a joint committee of the N.E.L. and the N.D.H.A. on actual steam operating costs in various industrial buildings, are given in full. The figures include the principal items in the operation of some 32 office buildings, plants and store.

Current Heating and Ventilating Literature.

Under this heading is published each month an index to the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

HOT-WATER HEATING

Hot-Water Heating Under Forced Circulation. Charles D. Allan. Ills. 1,200 w. Power—Oct. 9, 1917. Serial, 1st part. First of six articles. Present article explains the elemental mechanical principles of hot-water heating.

SKATING RINKS

Ice Skating Rinks. M. R. Carpenter, with discussion. Ills. 16 pp. A. S. R. E., Jl.—Sept., 1917. Summary of essential points to be considered.

VENTILATION

Factors in the Ventilation of Schools, Assembly Halls and Business Buildings. George E. Reed. 2,500 w. Ore Soc. Engrs., Jl.—Sept., 1917. Discusses artificial ventilation, air washers, air filters, etc.

Death of J. O'Meara.

It has not been generally known in the trade that J. O'Meara, of New York, inventor of the O'Meara valve, extension spindle for valves, and many other devices, died some time ago of diabetes, at his home in Brooklyn. One of Mr. O'Meara's most successful inventions was a vulcanized rubber disc and white metal disc. He was for many years engineer at the Union Club, New York, and later organized the O'Meara Valve Co., of Arlington, N. J. He had a wide circle of friends in the New York trade.

New Form of Ductometer.

An interesting form of ductometer, for use in proportioning duct systems, has been developed by George P. Bender, C. E., New York, and is shown half-size in the accompanying illustration. It consists of two discs, one superimposed on the other and pivoted in the center. The lower disc, which is opaque, has on it an outer scale representing the quantity of air per minute to be delivered and is used to find the dimensions of the duct for area. A scale marked "Friction in inches of water per 100 ft. of duct," represents the loss of head due to friction. A scale marked "Quantity, cu. ft. A.P.M.—for friction" represents the relation between the quantity air per minute and the frictional size of the duct, and is used to find the pressure-loss when the duct size is known. There is also an inner scale on which the radial lines represent the smaller size of the duct, the circular lines the larger size of the duct, and the radial curves the increase in area of a rectangular duct of equivalent friction as compared with a square duct. The curves represent the length of the side of a square duct, the diameter of a circular duct of equivalent frictional resistance as compared with a square duct, and the diameter of a circular duct of equivalent area as compared with a square duct, respectively.

The upper disc is transparent and has on it an outer scale which represents the velocity in feet per minute; the indicators, A, B, C and D, which represent the constants for frictional losses in ducts of smooth metal, smooth plaster or concrete, rough plaster or concrete, and brick, respectively, for air at 70° F.; an inner scale which represents both the larger size of a rectangular duct, and the length of a square duct; and an indicator curve.

FORMULA USED IN DESIGNING DUCTOMETER.

The design of the ductometer is based upon the well-known formula:

$$H = 4\frac{kLv^2}{2gD} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

in which,

H = head in feet causing flow
k = constant
L = length in feet
g = acceleration due to gravity
v = velocity in feet per second
D = diameter of duct in feet

also,

$$H = f\frac{w}{12a} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where,

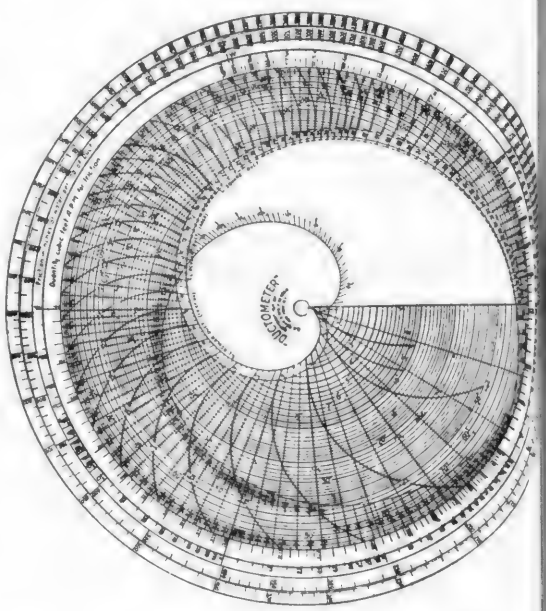
f = head, expressed in inches of water
W = density of water
A = weight of air in lbs per cu. ft.

In practice, however, it is convenient to express the quantity in cubic feet A.P.M., the velocity in feet per minute, and the duct-sizes in inches. Therefore, we have,

$$\text{where } f = \frac{851.93\ AkLQ^2}{2g\pi^2d^5} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

f = friction loss expressed in in. of water
A = weight of air in lbs. per cu. ft.
L = length of duct in feet
Q = quantity cu. ft. A.P.M.
g = acceleration due to gravity
d = diameter of duct in inches.

But, as we are dealing with square and



NEW FORM OF DUCTOMETER FOR PROPORTIONING DUCT SYSTEMS. (Half Size.)

rectangular ducts, as well as circular ones, the equation, in a more convenient form, becomes,

$$\frac{2gf}{26.62AkLQ^2} = \frac{32}{\pi^2d^5} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

and,

FIG. 1.—BAETZ PORTABLE BLOWER HEATER UNIT.

$$\frac{32}{\pi^2 d^5} = \frac{2}{z^5} = \frac{x+y}{x^3y^3} \quad \ldots\ldots\ldots\ldots\ldots (5)$$

where,

x = the longer side of the duct
y = the shorter side of the duct
z = the length of the side of a square duct

Equations 4 and 5 give the sizes of square and rectangular ducts, having the same frictional resistance per unit of length as a round duct, with the same quantity of air per minute.

The ductometer is also adapted for finding the flow of water and loss of head in pipes. For ventilating work it has a range of sizes from 1 in. × 1 in. to 120 in × 120 in., with equivalent round and rectangular ducts, for both area and friction. Quantities from 100 to 1,000,000 cu. ft. of air per minute, and frictions from 0.0001 in. to 100 in. water gauge per 100 ft. of duct.

In a booklet entitled, "The Ductomer and Its Use," published by R. D. Ward and George P. Bender, C. E., 120 Broadway, New York, several typical examples are given to show the operation of the ductometer, accompanied by rules for the use of the ductometer in seven different cases. Directions are also given for applying the ductometer to problems in the flow of water in pipes.

A Portable Blower Heating System.

Some remarkable features of compactness and adaptability are to be noticed in a new type of portable blower system of heating which has been placed on the market by Skinner Bros. Mfg. Co., St. Louis, Mo., under the name of the Baetz air heating apparatus. These units, it is stated, are in successful operation in many of the largest foundries and industrial plants in the United States and they are especially recommended for heating large exposed buildings. Other uses of the Baetz heating system are in connection with the removal of steam and vapor in large packing houses and paper mills. In many cases they are used for both heating and vapor removal. They also serve for drying purposes in the manufacture of such products as fire-brick, candy, shoes, etc.

The Baetz heater is constructed of steel plates and angles. The upper part is occupied by coils of steam pipe, arranged so that they may be readily removed for repairs. A blower or fan is placed beneath them in the same enclosure. Air is drawn

FIG 2.—CONSTRUCTION OF COILS IN BAETZ HEATER.

in by the fan from two sides and is forced upward against the steam-heated coils, passing out at the top as heated air. It will be noticed that the fan does not handle the heated air, thus increasing its capacity.

A conventient line shaft, a small engine or motor may be used to propel the fan. The heater is provided with a suitable shelf at the top upon which a motor can be placed.

To make ready to place in operation all that is required is to connect live or exhaust steam to the pipe shown at the upper right-hand corner of Fig. 1. The other pipe just below is the drain and is to be conected to the return line to the boiler.

Fig. 2 shows the construction of the coils, the methods of connecting the coils to the heater, the positive system of draining the coils and the ease with which they may be removed. It also shows the construction and location of the fan directly under the heating coils.

The manufacturers point out that when a small steam engine is used for driving the fan the exhaust steam from the engine can be piped direct into the heater coils.

Trade Literature.

WESTINGHOUSE DIRECT-CURRENT MOTORS AND GENERATORS are the subject of the second of a series of catalogues of industrial motors which has just been distributed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This is known as Catalogue 30 and embraces the company's complete line of direct-current motors and generators for industrial service. The new catalogue is identical in size and will fit the binder for the company's line of catalogues covering supply apparatus and small motors. Size 8¼x10¾ in. Pp. 80, with index.

NATIONAL ROTARY OIL BURNERS for use in house-heating boilers, hot water heaters or warm-air furnaces, are illustrated and described in a circular received from the National Rotary Oil Burner Co., Boston, Mass. These burners may be installed by removing the two center grates and slipping the burner in the ashpit door, letting the base of the burner rest in the ashpit. The oil tank can be placed outside the basement and underground, if desired. A small motor is used to operate the burner and produce combustion, which drives a spray plate and fan. Directions are given in the circular for operating the burner and emphasis is laid on the economy of this arrangement, compared with the use of coal. Automatic control is obtained by the use of a regulator furnished by the company. Comments of satisfied users are included in the bulletin.

BRAEMER HUMIDIFIERS AND DEHUMIDIFIERS, for humidifying, cooling, dehumidifying, and for low-temperature drying work, are featured in newly-issued circular matter received from the Braemer Air Conditioning Corporation, Philadelphia, Pa. A list of some of the more noteworthy installations is given, with the announcement that the company is prepared to design air conditioning apparatus for industrial processes of every description. Other circulars issued by the company are devoted to the Webster "Type A" air washer for securing moderate cooling effects, as in public buildings, and the Webster "Type B" air washer, for securing the greatest cooling effect possible by evaporation.

ABRAMS GAS FURNACE, designed especially for use with natural gas in heating buildings, is called to the attention of the trade through a new catalogue devoted to this apparatus, which is manufactured by the Abrams-Orton Mfg. Co., Wadsworth, O. The Abrams burners, which are an interesting feature of this furnace, are placed lengthwise of the firebox and through the casing, so that they may be removed without extra trouble. Being a sawed burner, it serves to eliminate the noise, and the placing of the burners in the manner described serves to distribute the fire the full length of the firebox. The air for combustion is taken from three tubes that connect the firebox to the bottom of the casing. The fire-box is raised 12 in. from the bottom of the casing to allow the fresh air to travel around fire-box. These tubes act as a cellar ventilator as well as for its purpose of supplying air for the gas. This air, as it reaches the firebox, is conducted to the burners by a baffling plate which allows it to pass on either side of the burner and come in contact with the blaze. The heated fumes from the fire-box travel to the radiators that are bolted to top part of fire-box, spaced three inches apart. These radiators are bolted and packed with asbestos. They are 2½ x 21 x 36 in. high, having 1728 sq. in. of radiating surface each. From the radiators the fumes travel through a tube which, being small, retains part of the heat in the radiator, traveling through these tubes to a vent manifold around the dividing plate to the chimney connection. The furnace is lighted with a pilot light on the outside of cast plate. Size 5 x 7 in. Pp. 16.

COMPUTING RADIATION.

In computing the amount of radiation, the kind of radiator surface to be used, its method of installation whether direct, recessed, concealed or indirect, the work it must do and its position in the room—all bear upon the matter. Care must be taken to distinguish between *actual* radiator surface and *equivalent* direct radiator surface (E. D. R.). Actual radiator surface is the actual exposed radiating surface expressed in square feet but E. D. R. depends entirely on its efficiency. Equivalent direct radiation (E. D. R.) is most easily defined as being ¼ lb. of steam (or 250 B. T. U.) per hour, this being the approximate condensation of 1 sq. ft. of actual cast-iron radiator surface under ordinary operating conditions.

Thus, if an indirect radiator of 10 sq. ft. actual surface is giving off heat at the rate of 400 B. T. U. per square foot per hour (or has an *efficiency* of 400 B. T. U.) its total B. T. U. delivered will be $10 \times 400 = 4000$, but its E D. R. will be 4000/250, or 16 sq. ft. In figuring boiler capacity, pipe sizes, and all other calculations relating to the heat delivered, steam required or condensation to be handled, the E. D. R. should be used as a basis of calculation.

Having found the B. T. U. required to heat a given room by use of the factors and formulae previously given on Data Sheets Nos. 1-7 calculation of the required radiating surface is usually made by dividing the total B. T. U. to be supplied by 250, which is the assumed efficiency of all radiation per square foot. While it is true all radiation does not give this efficiency (for exact results of tests on different styles of radiators see Standard Data Sheet No. 13-A) it is much easier to use the 250 divisor and then to add a percentage than to use a multitude of different divisors.

The only variation from this should be for indirect heaters which, for gravity work, are usually considered as having an efficiency of 400 or 500 B. T. U., and for pipe coils, which are usually considered as having an efficiency of 300 B. T. U., unless on the ceiling where the undesirable position causes such a reduction of efficiency that 250 B. T. U. is again correct.

Radiators installed so that the air does not circulate freely around them suffer a loss of efficiency and must be increased as follows:

Cast-iron radiators on ceiling	10%
Recessed radiators	20%
Concealed	40%
Radiators near doors	100%

The increase of radiators near doors is to have extra surface to counteract drafts when the doors are opened and to care for the larger leakage loss encountered in such locations.

EFFICIENCY OF RADIATING SURFACE

The efficiency of radiating surface varies in different types of radiators although not to such an extent as to make any great difference in the amount of surface used. The co-efficients of efficiency are computed by multiplying the condensation (in pounds per sq. ft. per hour) by the latent heat of the steam at its pressure and dividing by the temperature difference between the room and the steam in the radiator. Otherwise the co-efficient may be said to be the number of B. T. U. transmitted per square foot of heating surface per hour per degree difference.

Tests made by Professor R. Allen at the University of Michigan show those co-efficients to be as follows and column 4 is computed from column 3 on the basis of 5 lbs. of steam pressure and 150 degrees temperature difference.

Type of Radiating Surface.	No. of Pounds Condensed per Sq. Ft. per hr.	Co-efficient of Transmission B.T.U. per deg.	Efficiency of Surface B.T.U. per Sq. Ft. Per hr.
CAST-IRON			
1-column	0.212	1.82	273
2-column	0.265	1.65	248
3-column	0.204	1.45	218
6-column	0.217	1.35	202
5 sq. ft. wall (vertical)	—	1.92	288
5 sq. ft. wall (horizontal)	—	2.11	317
7 sq. ft. wall (vertical	—	1.70	255
7 sq. ft. wall (horizontal)	—	1.92	288
9 sq. ft. wall (vertical)	—	1.77	265
9 sq. ft. wall (horizontal)	—	1.98	297
Bare pipe coils			
1 Pipe high	0.410	2.80	420
4 Pipes high	0.425	2.48	372
PRESSED STEEL			
2-column	—	1.53	222

EXAMPLE OF COMPUTING DIRECT RADIATION

Assume a room with three windows and one door with a computed loss of 20,000 B. T. U. Then the direct radiator surface will be 20,000/250 = 80 sq. ft. for either cast-iron radiators or pipe coils on the ceiling.

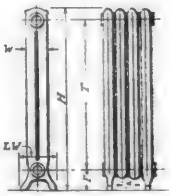
80 + 10% = 88 sq. ft. for cast-iron ceiling radiators.
80 + 20% = 96 sq. ft. for cast-iron recessed radiators.
80 + 40% = 112 sq. ft. for cast-iron concealed radiators.

If ordinary exposed radiators are used they may be divided into four radiators of 20 sq. ft. each—which, however, is rather too small for practical use. Probably three would be used, two of 27 sq. ft. and one—near the door—of 54 sq. ft.

For pipe coils along the walls near the floor the surface would be 20,000/300 = 67 sq. ft.

AMERICAN RADIATOR COMPANY'S ROCOCO ONE-COLUMN RADIATORS FOR STEAM AND WATER

No. of Sections	*Length 2½ in. per Sec.	Heating Surface—Square Feet: 38-in. Height 3 sq. ft. per Sec.	32-in. Height 2½ sq. ft. per Sec.	26-in. Height 2 sq. ft. per Sec.	23-in. Height 1¾ sq. ft. per Sec.	20-in. Height 1½ sq. ft. per Sec.
2	5	6	5	4	3½	3
3	7½	9	7½	6	5	4½
4	10	12	10	8	6⅞	6
5	12½	15	12½	10	8½	7½
6	15	18	15	12	10	9
7	17½	21	17½	14	11⅞	10½
8	20	24	20	16	13¾	12
9	22½	27	22½	18	15	13½
10	25	30	25	20	16⅞	15
11	27½	33	27½	22	18⅞	16½
12	30	36	30	24	20	18
13	32½	39	32½	26	21⅞	19½
14	35	42	35	28	23⅞	21
15	37½	45	37½	30	25	22½
16	40	48	40	32	26⅞	24
17	42½	51	42½	34	28⅞	25½
18	45	54	45	36	30	27
19	47½	57	47½	38	31⅞	28½
20	50	60	50	40	33⅓	30
21	52½	63	52½	42	35	31½
22	55	66	55	44	36⅞	33
23	57½	69	57½	46	38½	34½
24	60	72	60	48	40	36
25	62½	75	62½	50	41⅞	37½
26	65	78	65	52	43½	39
27	67½	81	67½	54	45	40½
28	70	84	70	56	46⅞	42
29	72½	87	72½	58	48¾	43½
30	75	90	75	60	50	45
31	77½	93	77½	62	51⅞	46½
32	80	96	80	64	53⅓	48



Connections: WATER—Extra-heavy right and left-hand nipples at top and bottom. STEAM—right threaded, extra-heavy nipples at bottom only.

* Add ½ in. to length for each bushing.

Low-Drip Hubs: ONE PIPE STEAM—on supply leg section; TWO-PIPE STEAM on return leg section.

DIMENSIONS

H = Total overall height.
T = C. to C. of tappings on water radiators.
F = Floor to center of bottom tapping.
W = Width of radiator—4 13/32 in.
LW = Width of radiator legs—5⅜ in.
S = Width of radiator sections; *i.e.*, c. to c. of sections, or 2½ in.

Nominal Height of Radiator	38-in.	32-in.	26-in.	23-in.	20-in.
H	37 5/8	31 47/64	26	23 3/32	20 11/64
T	31 3/32	25 13/64	19 15/32	16 9/16	13 41/64

Note: For legless radiators deduct 3-in. from H.
For high legs add 2-in. and for extra high 4-in. to H and F.

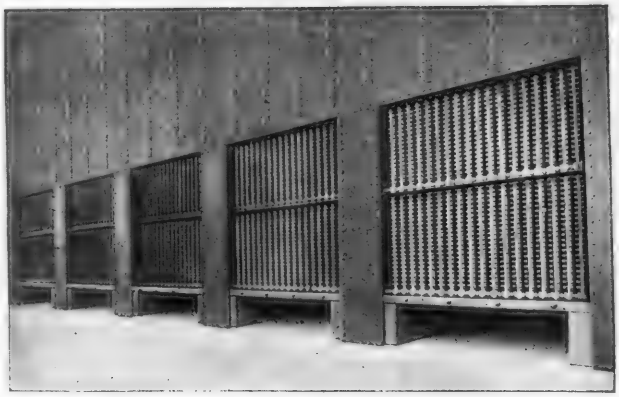
TAPPING DATA

All radiators are tapped 2-in. and bushed as follows:

SYSTEM	Size of Radiator, Square Feet	Supply In. Diam.	Supply F In.	Return In. Diam.	Return F In.
Steam, one-pipe	Up to 24, inc.	1	4	..	..
	24 to 60, inc.	1¼	4	..	..
	60 to 100, inc.	1½	4	..	..
	Over 100	2	4	..	..
Steam, two-pipe	Up to 48, inc.	1	4½	¾	4
	48 to 96, inc.	1¼	4½	1	4
	Over 96	1½	4½	1¼	4
Water	Up to 40, inc.	1	4	1	4
	40 to 72, inc.	1¼	4	1¼	4
	Over 72	1½	4	1½	4

Air valve tappings are ⅛ in.
Vapor tappings, top and bottom, opposite ends, ¾ in. supply and ½ in. return.
All tappings with right-hand threads unless otherwise ordered.

Heating and ventilating large buildings



Large banks of VENTO Heaters supplying warmed fresh air in a Kansas City school building. Shows the great range of sizes possible with VENTO Heaters

All buildings, such as factories, schools, universites, colleges, churches, stores, banks, hospitals, hotels, theatres, libraries, and museums requiring large volumes of air freshly warmed by steam, vapor or water are efficiently served by

VENTO Heaters

Send for our complete manual of engineering information containing tables of data on temperatures, condensations, ratings, free areas with charts on best methods of connection, etc.

Engineers and heating contractors should use this book for its valuable information.

AMERICAN RADIATOR COMPANY

Sales branches and showrooms in all the large cities

Cast-Iron and Copper Do Not Corrode

In selecting materials for manufacturing the

Alberger Multi-Head Heaters

the aim is to choose those which are subject to the least deterioration from use, with the result that only the best grades of cast-iron and copper are used. Steel and even charcoal iron are not used. The tubes are of pure copper.

All water and steam connections are on the body of the shell, providing easy access to the heating surface.

"The closed Heater without the usual Closed Heater Troubles"

Our Manual on "Heating Water with Steam" gives interesting details

ALBERGER HEATER CO.

Buffalo, N. Y.

WESTERN OFFICE:
Peoples Gas Building, Chicago
Agents in all principal cities

ADVERTISERS' INDEX

Alberger Pump & Condenser Co..... 7
Alberger Heater Co..... 72
American Disrict Steam Co..... 89
American Blower Co..... 81
American Pressweld Radiator Corporation ..... Fourth Cover
American Radiator Co..... 71
Anderson, A. H..... 82

Bayley Mfg. Co..... 11
Bicalky Fan Co..... 14
Braemer Air Conditioning Corporation 84
Bristol Co., The..... Front Cover
Byers Co., A. M..... 6

Carrier Air Conditioning Co..... 85
Carrier Engineering Corporation..... 4
Cast Iron Pipe Publicity Bureau..... 8
Central Station Steam Co..... 88
Chicago Pump Co..... 78
Clarage Fan Co..... Second Cover
Connersville Blower Co..... 3

Davis Regulator Co., G. M..... 90
Detroit Lubricator Co..... 77
Dole Valve Co..... Front Cover
Dunham Co., C. A..... 14

Economy Pump Machinery Co..... 85

Farnsworth Co..... 80
Fulton Co..... 10

Gurney Heater Mfg. Co..... Front Cover

Haines & Co., Wm. S..... 9
Hornung, J. C..... 89
Howard & Morse..... 73

Ilg Electric Ventilating Co..... 76
Illinois Engineering Co..... 12

Jenkins Bros..... 75
Johns-Manville Co., H. W..... 79
Johnson Service Co..... 78

Knowles Mushroom Ventilator Co., Front Cover

Lavigne Mfg. Co..... 9
Lord & Burnham Co..... Third Cover

Marsh Co., Jas. P..... 3
Mason Regular Co..... Front Cover
McAlear Mfg. Co..... 12
Moline Heat..... 79

National Tube Co..... 5

Ohio Blower Co..... 82

Patterson-Kelley Co..... 80
Powers Regulator Co..... 74

Ric-Wil Co..... 88
Ross Valve Mfg. Co..... Front Cover

Sarco Company, Inc..... 90
Schaeffer & Budenberg Mfg. Co..... 82
Sims Co., The..... 10
Sprague Electric Works..... 11
Standard Thermometer Co..... 75
Standard Wood Pipe Co..... 88
Sturtevant Co., B. F..... 83

Taylor Instrument Companies..... 86

Underground Specialty Co..... 86
United Vacuum Appliance Co..... 85

Webster & Co., Warren..... 84
Westinghouse Electric & Mfg. Co..... 87
Wyckoff & Son Co., A..... 88

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

John D. Small, Chicago, Ill., consulting engineer, announces the removal of his offices to Room 1601, 20 East Jackson Boulevard.

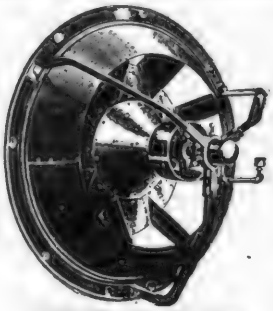
Explosions of boilers in connection with heating plants are reported from Junction City, Kan., and from Princeton, Mo., during the past month. At Junction City the cause was a frozen expansion tank of a hot water heating system in a residence. One fatality resulted. At Princeton the cause was a frozen water pipe connected with the boiler. This was also a residence system. In an effort to increase the heat the boiler was rushed and an extremely high pressure generated. When the boiler let go, water ran down into the firepot, sending a cloud of steam and water into the basement, seriously injuring two persons who were in the basement at the time.

Manufacturers' Notes.

United States Radiator Corporation, Detroit, Mich., has opened a branch office in Indianapolis. J. F. Esperon, for several years with the company's Chicago office, is in charge.

Kellogg-Mackay Co., Chicago, Ill., announces that C. V. Kellogg, president of the company, has acquired the entire interest in this concern. In this connection Mr. Kellogg states that he has sold his interest in the Pierce, Butler & Pierce Mfg. Corporation to eastern business men. It is said that the transaction involved approximately $1,000,000. The Kellogg-Mackay Company will continue to handle the same line of boilers, radiators and heating and plumbing supplies.

Wm. B. Scaife & Sons Co., Pittsburgh, Pa., manufacturers of water tanks, has applied for a Pennsylvana charter, with a capital of $850,000. The company has here-



DUPLEX CONE FAN
Belt Driven

HOWARD & MORSE
45 FULTON ST., N. Y.
Ventilating Engineers and Contractors
MANUFACTURERS OF
BLACKMAN and DUPLEX CONE FANS
which are installed by us complete with **Motors, Duct Work** and **Wiring.**

Aligning, Rigging and **Hoisting** done, with labor thoroughly qualified from long experience.

We make a specialty of **Kitchen Exhaust** work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations.

The **Duplex Cone** Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The **Blackman** Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.

SEND FOR CATALOGUE

BLACKMAN FAN
Direct Connected to Motor

tofore operated under a New Jersey charter. It is stated that no change has been made in the company's personnel or in its products.

Walworth Mfg. Co., Boston, Mass., manufacturers of iron fittings, valves, Stillson wrenches, etc., has elected J. C. Bannister as vice-president of the company. Mr. Bannister has been connected with the manufacture of this type of product for 26 years. He was for three years superintendent of the Kewanee Boiler Company, and when the National Tube Company took over the operation of its Kewanee plant, Mr. Bannister was made manager of the Kewanee works. The Walworth Mfg. Company purchased the Kewanee works in August, 1917, Mr. Bannister will maintain his headquarters in Kewanee for the present.

Central Station Heating Notes.

La Crosse, Wis.—In connection with the application of the Wisconsin-Minnesota Light & Power Company for an increase of 40% in its heating rates, opponents of the increase testified that the company is making profits equal to 16% on its common stock, after paying all capital charges. The commission has the case under consideration.

Muncie, Ind.—The Muncie Electric Light Company has been granted permission to increase its flat rate for steam heating for the remainder of the present season, which ends May 1, 1918, and to eliminate flat rate heating entirely at the end of the season. The new rate is 35 cents per square foot of radiation installed, instead of 25 cents. This new rate is considerably below that proposed by the company, but it is stated the rates will be completely readjusted after next May. At a meeting of the city council, City Attorney John McPhee was instructed to appeal to the Delaware Circuit Court or, if necessary, to file suit, to set aside the commission's ruling on the ground that the commission did not give due consideration to the objections made by the city.

Springfield, Mo.—Increase in steam heating rates asked for by the Springfield Gas & Electric Company will not be granted this winter. It was the ruling of the Missouri Public Service Commission that the present rates cannot be suspended before the expiration of 120 days, or

Control Hot Water This Way

Economy, Safety and Efficiency demand that Water Heaters shall be automatically controlled. The Powers Tank Regulator is a safe and sure controller.

The No. 11 Regulator illustrated is designed especially for Hot Water Tank Heaters.

The "bulb" (A) is inserted through side of tank, into water. Flexible tube (B), any length desired, connects bulb (A) with motor (C) which operates steam valve (D). Motor (C) is set by adjustable spring, to operate at temperature desired.

When water in tank reaches that point, fluid in bulb (A) is vaporized, the pressure being communicated to motor (C) through flexible tube (B) results in closing steam valve (D). When temperature of water falls, the process is reversed, and spring opens steam valve.

The same principle is used in other Powers Regulators for controlling coal or gas-heated tanks.

We have had 30 years of experience in this work. The experience is at your service.

THE POWERS REGULATOR CO.

Specialists in Automatic Heat Control

954 Architects Building, New York
2143 Mallers Building, Chicago
365 The Federal Street Bldg., Boston

Canadian Powers Regulator Co., Ltd., Toronto, Ont.

March 20, 1918. It was stated that failure on the part of the company to comply with the directions of the commission as to proper publication of the proposed changes in rates was the reason for the commission's refusal.

Des Moines, Ia.—According to an announcement made by M. G. Linn, general manager of the Des Moines Electric Co., which was awarded a franchise last March for the construction of a central heating plant in that city, no step towards the construction of the plant will be taken until after the present war. Under the terms of the franchise the plant is scheduled to be completed by October, 1918. Inability to secure material and the commandeering of manufacturing plants by the government are given as the reason for the abandonment of all immediate plans. Thus far no work has been done on the plant.

Luverne, Minn.—The City Heating Company's plant is now complete. The system was installed by Bain & Robb, of Minneapolis, and represents an expenditure of $37,000. Of this amount $21,150 was provided through the sale of stock to business and professional men of the city, all of which is fully paid and non-assessable. The remaining amount is covered by local loans which will eventually be taken up by a bond issue by the company. There are 33 stockholders in the company, controlling 37 business structures which will be supplied with heat from the central plant.

St. Louis, Mo.—An application has been made by the Union Electric Light & Power Co. for permission to readjust its rates for steam heat. At a hearing on the petition it was argued by opponents of the raise that the company has no franchise for conducting a steam heating system and that therefore the commission has no jurisdiction. The commission decided to proceed with the hearing and to pass later on the question of jurisdiction.

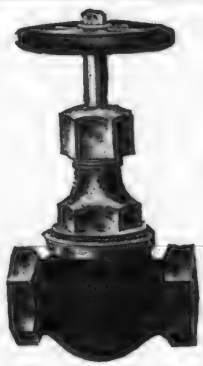
New Incorporations.

Drake Heating & Plumbing Co., Drake, N. D., capital $15,000. Incorporators: E. A. Hohman, John Beutler and William Beutler. **Swetland Heating & Appliance Co.**, Cleveland, O., capital $25,000. Incorporators: W. D. Valentine, T. M. and F. D. Swetland and L. B. Peck.

Contracts Awarded.

Sanitary Plumbing & Heating Co., Sioux Falls, S. D., heating and ventilating Moe Hospital for $30,000; also heating and ventilating Sioux Falls National Bank Building for $40,000; also heating the new cathedral in Sioux Falls for $30,967.

H. G. Newman Plumbing Co., Evansville, Ind., heating and ventilating new junior high school on the West Side for $32,716. The plumbing contract went to the S. A. Schmitt Plumbing Co., at its bid of $18,501.



Jenkins Bros. Valves

are always sold under a guarantee of service and satisfaction. It is less expensive to maintain valves bearing for identification the Diamond Trade Mark, with interchangeable parts throughout, than to have the trouble and expense of replacing valves which have no provision for repairs.

There's a Jenkins Bros. Valve for every purpose. Include them in your specifications.

Jenkins Bros.

New York Boston Philadelphia Chicago Montreal London

STANDARD THERMOMETERS - Indicating and Recording

for VACUUM, STEAM and HOT WATER SYSTEMS, BAKE OVENS and COLD STORAGE PLANTS. SEVEN models of RECORDING and EIGHT of INDICATING Thermometers. All Accurate, Durable and Legible.

Backed by thirty years of Thermometer manufacturing.

They are practically indestructible, are sensitive to changing temperatures and are very easily installed. Supplied with horizontal or vertical extension and standard pipe thread.

Ask for catalog No. 100-107 and trade prices.

STANDARD THERMOMETER COMPANY, 65 Shirley St., Boston, Mass.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write*

Ochempaugh & Chilson, Ames, Ia., heating and plumbing consolidated school building in Strahan, Ia., for $14,309.

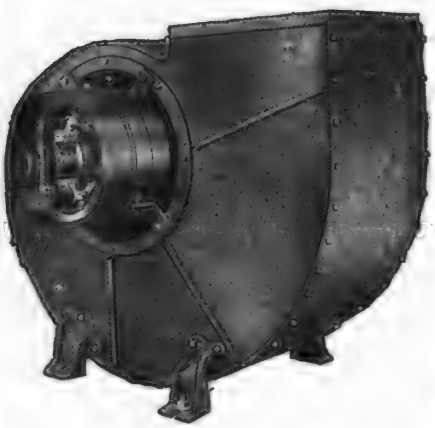
Coal Economy and the Heating of Street Cars.

A proposal to allow street cars to go unheated as a war-time economy has aroused the public in several cities. In Burlington, Ia., the city council passed a resolution stating that:

"WHEREAS, Many of the street cars operating within the city are insufficiently heated; be it

"*Resolved,* That the Street Railway company be requested to maintain and operate the car heating systems so that the public may ride therein in reasonable comfort, or if the present equipment is not sufficient, to install additional heaters."

In Detroit, the board of health, through Dr. Henry M. Vaughan, has expressed the opinion that it would be poor war-time economy to save a little coal at the expense of the health of the general public, claiming that it is detrimental to health for the public to sit or stand for periods of time in unheated cars, without exercise. He said the board of health would prosecute the street railway company for any let-down in the required temperatures for street cars. At present the minimum street car temperature required is 35° F. and the maximum, 65°.



The Vital Spot

in a Blast Heating System is AT THE BLOWER

If the Blower is

Ilg Universal

You can be sure that it will be reliable

Motor and Blower

ARE BUILT BY US and COVERED BY

ONE GUARANTEE

The one-name plate feature is your protection

ILG ELECTRIC VENTILATING CO.
158 Whiting St., CHICAGO
Branches: All Cities

DETROIT PACKLESS RADIATOR VALVES

The Correct Valve for the Beautiful Home

Detroit Packless Valves are finished with the definite purpose, that they shall harmonize with the most beautiful surroundings. In addition to their unusually pleasing appearance and smooth satin finish they are permanently efficient and will not leak or need repacking.

Booklet VP-1 Gladly Sent Upon Request

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO.

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

A census of the manufacture of iron and steel, including the blast furnace, steel-works and rolling-mill, wire and tin-plate and terneplate industries, has been published by the Bureau of the Census Department of Commerce, as a supplement to the Census of Manufacturers: 1914. It is presented under the authorship of Story B. Ladd and was prepared under the supervision of W. M. Steuart, chief statistician for manufactures. Size 9x11½ in. Pp. 68.

New Heating and Ventilating Class at the Bronx Y. M. C. A., New York.

A school of heating and ventilating at the Bronx Y.M.C.A., 161st and Washington

CHICAGO TURBINE VACUUM PUMP

Will Maintain a Vacuum and Return Condensation Directly to Boiler

YOU WILL BE SURPRISED AT ITS SIMPLICITY

Has no gears, pulleys, valves, plungers, intermediate piping connections or complicated separating mechanism.

The entire equipment comes in one Cast-Iron Receiver, all ready for piping and wiring connections. No assembling or complicated piping to do on the job. Illustration shows complete vacuum pump.

WE CAN MAKE A PROMPT DELIVERY

CHICAGO PUMP CO., 900 W. Lake St., Chicago, Ill.

Manufacturers of
BILGE PUMPS, SEWAGE EJECTORS and CONDENSATION, CIRCULATING and HOUSE PUMPS

Johnson { Heat / Humidity } Control

Always the Leader in Inventions and Improvements

First: Practical Heat Regulation.

Second: Pneumatic Thermostats.

Third: Humidostats—the first practical apparatus for the control of humidity.

Fourth: The "SYLPHON" Metal Diaphragm Valve for heat control, the one thing needed to make heat regulating systems durable and reliable. We tested this valve three years before we offered it for use. Untested imitations and substitutes followed fast, but having been thoroughly tested and proven equal to all demands,

the "SYLPHON" is the Recognized Standard.

Fifth: Unequalled Service in all Departments.

Johnson Service Company

Milwaukee, Wis.

Offices in all Large Cities

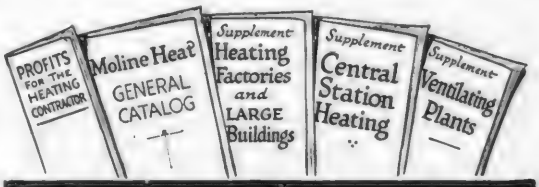
Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Avenue, New York, has been inaugurated by Charles A. Fuller, who is the director of the New York School of Heating and Ventilation. The course consists of twelve lectures on Wednesday evenings beginning December 5, 1917. The remaining six lessons for the latter part of January and February will be on piping systems, indirect systems, boiler and boiler plant layout for low-pressure systems, hot blast heating, and ventilation of schools, hotels, churches and theatres.

Annual Report of Bureau of Standards.

Scientific work of unusual volume and interest is described in the annual report of the director of the Bureau of Standards, just issued. Since the war began, all branches of this scientific bureau have been conducting researches on technical problems of military application. The regular work, however, has not been overlooked.

While no investigations have been made bearing directly on heating and ventilation, the work has included the standardization of blood-counting apparatus and other measuring instruments. The regular growth of the bureau and its special expansion on account of the war has resulted in the construction



THESE VALUABLE BOOKS *FREE!*

Each one is worth big money to you. Every heating contractor should have them. They cover all the latest money-making ideas in figuring and installing steam heat—hot water heat—vapor heat—and vacuum systems.

These books will help you to land more orders and increase your profit on every job. Write for them at once. They are absolutely *FREE!*

Moline Illinois

Just a Ball—that's all

OFTEN it's the smallest fitting that kicks up the most trouble. Either it's hard to connect up, or the adjustment is delicate, or some little part keeps wearing out. And, on jobs where your margin is small, these little troubles play hob with profits.

So it will pay you to get acquainted with the Johns-Manville Radiator Valve—because it's the simplest on the market. Just three parts—body, ball, and connecting union; only one moving part—the hollow ball. It regulates itself—no nice adjustments, no chance of tampering. You'll find this valve a money-saver all along the line.

The Johns-Manville Steam Trap operates on exactly the same principle as the Johns-Manville Radiator Trap. Pamphlet and prices on application.

JOHNS-MANVILLE PIPE AND BOILER INSULATIONS: Asbesto-Sponge Felted, 85% Magnesia, Asbestocel, Zero Insulation, Anti-Sweat Insulation, Brine and Ammonia Insulation, Underground Steam Conduit and Insulating Cements.

H. W. JOHNS-MANVILLE CO.
NEW YORK CITY
10 Factories—
Branches in 60 Large Cities

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

JOHNS-MANVILLE

of several new laboratories and an increase in the staff of about 60%.

The United States Bureau of Mines, Department of the Interior, is sending out copies of the paper on "Preventable Waste of Coal in the United States; with a Consideration of Alternative Methods of its Elimination," by David Moffatt Meyers, as presented at the recent annual meeting of the mechanical engineers' society.

Help Wanted.

Wanted—Large Eastern Manufacturer of engineering specialties long established desires young man, not under 30 years, with technical education, good personality, and initiative; knowledge of heating, ventilation, and power plant engineering and installation practice essential. An excellent opportunity will be provided for development and promotion for the right man. Reply by letter giving full particulars and experience and salary expected. Replies will be treated confidentially. Address Manufacturer, care of Heating and Ventilating Magazine.

Condensation Pumps

7 Types

Send for catalogue and circular showing systems

FARNSWORTH CO.
Conshohocken, Pa.

THE ⌐¬ SHAPE TUBES EXPLAIN THE SUCCESS
of the
PATTERSON HOT WATER TANK

for heating water for domestic or manufacturing purposes. Both ends of each seamless brass tube are expanded into heavy cast-iron tube-heads with an improved roller expander. Their shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.

Type C. Patented Aug. 26, 1913.

Any Combination of Storage and Heating Capacities can be Furnished.
Send for Catalogue.

PATTERSON - KELLEY CO., 23 Dye Street, New York

Representatives in all Principal Cities.

In World's Finest Newspaper Plant

Two complete units of Sirocco Air Purifying Systems are serving in the new home of the Detroit News—undoubtedly the most modern newspaper plant in existence.

The top illustration at the left shows one of the two Sirocco Fan Outfits. The lower illustration shows one of the two Sirocco Air Purifying Systems.

It was our privilege to co-operate with Architect Albert Kahn, of Detroit, and the General Contractors, George A. Fuller Co., of Detroit, in the application of this Sirocco Equipment.

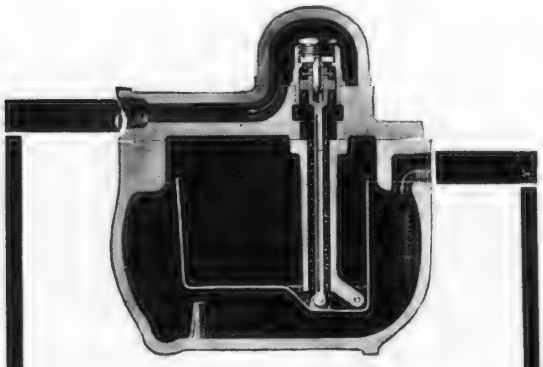
Our Engineering Department is glad to co-operate with Architects, Engineers and Contractors in connection with Sirocco application.

American Blower Co.

Detroit, Michigan

Branches in all Large Cities

Canadian Sirocco Co., Ltd.
Windsor, Ont.
Manufacturers for Canada



The SWARTWOUT

Hydromatic

TRADE MARK

STEAM TRAP

is a practical trap, made for long life and economical service.

It has 10 points for efficiency:

1. **Operates on gravity and buoyancy only.**
2. **Has only two moving parts.**
3. **Bucket hinged inside clear water.**
4. **Patented water-sealed valve.**
5. **The float can not collapse.**
6. **Monel metal valve and seat.**
7. **Positive in action.**
8. **Discharges water only—no steam.**
9. **Reversible valve and seat.**
10. **Guaranteed to work under any pressure up to 250 lbs. by simple change of valve and seat.**

With the price of coal where it is every coil or heater should be trapped. The Swartwout Hydromatic is easily installed and quickly adjusted.

Guaranteed to give satisfaction

Send for full details—free

The Ohio Blower Co.

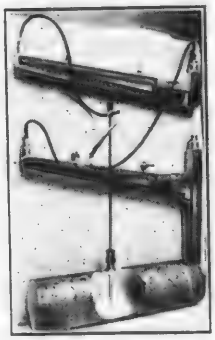
9211 Detroit Ave. **Cleveland, Ohio**

Do You Know How Much Air You are Using?

A PORTABLE PITOT TUBE

Should be used to test every air line.

Easy to Use—Accurate—Inexpensive



Each instrument is individually calibrated; each tube is nickel-plated, and furnished with plush-lined box.

The stuffing-box prevents leakage of gas around the stem; the tube may be rotated or moved in and out, or it may be clamped in any position by tightening the stuffing-box nut. The stem is graduated to tenths of an inch. Suitable for all diameters of pipe up to 24 in.

Instruction sheet gives constants applying to all usual applications.

Prices and further information on application

A. H. ANDERSON

3300 Federal St. **Chicago, Ill.**

If You Have Not a Set of Our Catalogs, Get It Today

"CRESCENT"

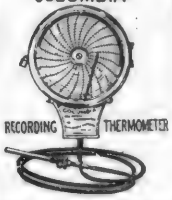
Thermometers for all applications

GAUGES

"S&B"

Steam, Vacuum Compound, Altitude, etc.

COLUMBIA"



It is more than a catalog—it is a text book on Instruments for Indicating and Reading Pressure, Vacuum Draft, Temperature, etc.

Write for Special Catalog Set HV Today

The Schaeffer & Budenberg Mfg. Co.

BROOKLYN, N. Y.

Chicago Pittsburgh Washington
St. Louis Philadelphia Los Angeles

"COLUMBIA"

RECORDING GAUGE

Also many other Allied Instruments, Gauge Boards and Complete Equipment

Sturdy as the Eternal Mountains
Accurate as a watch wheel
Sturtevant
(REG U.S. PAT. OFF.)
APPARATUS
"BUILDING to an ideal" may be a trite way of expressing the Sturtevant creed, but that is exactly the motive that inspires the men who are responsible for the Sturtevant reputation. On the land, on the sea, in the air, wherever Sturtevant apparatus is used, the man who uses it may feel certain that if it were possible to make a better piece of equipment, its name would still be Sturtevant.
Ruggedness, accuracy and reliability—these virtues are ingrained into every inch of Sturtevant Apparatus—and it is these virtues that are responsible for the ever-increasing use of Sturtevant Apparatus in the United States Navy, because the ideal dominating its makers is transmitted into the furthermost corners of our huge factory so that the most minute cog in the great Sturtevant machine may know that nothing short of *absolute perfection* will pass muster.
Catalogs on Sturtevant Fans and Prime Movers are yours for the asking
B. F STURTEVANT COMPANY
Dept. B, HYDE PARK, BOSTON, MASS
Fans Heaters Air Washers Motors Engines

Braemer

Air Conditioning Apparatus

Air Purifying Humidifying Low Temperature Drying
Air Cooling Dehumidifying High Temperature Drying
Industrial Ventilation Dust Removal Reclamation
Generator Coolers

Braemer Humidifier Installation

The conditioning of air in industrial plants to improve quality of product, for economy in operations, or to make rate and quality of production independent of weather, involves highly specialized problems.

The wide practical training of our engineers enables us to guarantee definite results in this work and suggest exactly the right type of apparatus.

Braemer Air Conditioning Corporation

Lafayette Bldg. PHILADELPHIA, PA.

Offices in Principal Cities

The WEBSTER System is Endorsed by Leading Architects, Consulting Engineers and Heating Contractors

The WEBSTER System is a method of circulating exhaust steam, live steam, or a combination of the two, to obtain not only the utmost efficiency, but the greatest economy.

Wasting exhaust steam, which might be put to profitable use in heating, is actually throwing money away, since all exhaust steam not so utilized requires additional live steam to be generated, at the added expense of fuel and labor, and the extra wear on the power plant

Webster Vacuum System of Steam Heating

has been installed in over 10,000 buildings during the past 30 years. This record has been achieved only by giving uniformly successful results.

The WEBSTER System is adapted to the heating problems of the manufacturer, whether his factory is housed in a single building or in an extended group of buildings.

Old buildings can be "Websterized," very often at comparatively little expense.

The WEBSTER System over comes "water-hammering," air-binding and excessive coal bills. Circulation of the steam is secured with little or no back pressure upon the engine. Webster Modulation Valves control the temperature in each room or department. Webster Sylphon Traps automatically discharge all air and condensation from radiators, pipe coils and drips.

Let us explain to you how the WEBSTER System will prove efficient, economical and reliable.

Write us today. Ask for Catalogue V-37

WARREN WEBSTER & COMPANY

MANUFACTURERS of Webster Systems of Steam Heating, Webster Feed Water Heaters, Webster-Lea Heater-Meters, Webster Steam and Oil Separators, Webster Steam Specialties

MAIN OFFICE AND WORKS ESTABLISHED 1888 **CAMDEN, NEW JERSEY** POINT AND PEARL STS
30 BRANCH OFFICES IN PRINCIPAL CITIES

"ECONOMY"
AUTOMATIC ELECTRIC
Cellar Drainers

Small Power
Large Capacity
Perfect Workmanship
Highest Quality Materials
Rock Bottom Prices Made Possible by Quantity Production

Economy Pumping Machinery Co.
112-118 North Carpenter St., Chicago, Ill.

RECOMMEND
CONNERSVILLE VACUUM CLEANERS

None too Large
None too Small

MANUFACTURED BY
United Vacuum Appliance Co.
Connersville, Ind.

Carrier Equipped

buildings for **Public—Industrial**—and **Office** use are

COOL IN SUMMER
WARM IN WINTER

and have an abundant supply of pure, fresh air all the time.

Other systems may be cheaper—other guarantees may be higher—but **results** are what count. And to be sure of getting the **best results** specify

CARRIER

There is no equal.

Shall we send our engineer —or catalog 13-36?

Both are waiting to tell you WHY.

CARRIER AIR CONDITIONING COMPANY OF AMERICA
Buffalo, N. Y.

New York Boston
Chicago Philadelphia

Tycos
TEMPERATURE INSTRUMENTS

Indicating Recording Controlling

will meet in full measure, the exacting demands of your especial manufacturing problems. Of this we are confident, feeling that, through the entire complex process in the manufacture of our instruments the influence of our years of experience surely must be reflected.

No matter what problem in thermometry you may have to face let us assume the responsibility of providing the proper instruments.

And to that end correspondence is invited.

Tycos Mercurial, Recording and Index Thermometers for all industrial and laboratory applications.
Electric Contact Thermometers.
Temperature, Pressure and Time Regulators.
Mercury Column Vacuum, Pressure and U Gauges.
Tycos Base Metal, Rare Metal and Radiation Pyrometers, (Indicating and Recording) Fery Radiation Pyrometers.
Hygrometers
Hydrometers.
Mineral Oil Testing Instruments
Aneroid and Mercurial Barometers
Recording Barometers.
Pocket Compasses.
Surveying Compasses.
Rain Gauges.
Anemometers and Air Meters.
Thermographs.
Hand Levels.
Aviation Barometers.
Inclinometers.
Tycos Sphygmomanometers.
Tycos Fever Thermometers and Urinary Glassware.
Thermometers of all kinds for home and general use.

Taylor Instrument Companies
Rochester, N. Y.

No. 29

Quick Installation and Permanent Service

are obtained with

STATEN'S
High-Efficiency Sectional
STEAM CONDUIT

Staten's Sectional Steam Conduit is thoroughly salt glazed tile especially made up in half sections, with roll-frame pipe supports and special conduit insulation, installed complete, ready for steam pipes, by us.

Complete specifications for installing Staten's High-Efficiency Sectional Conduit and Estimates of Cost furnished upon request.

UNDERGROUND SPECIALTY CO., Inc., 1476 Broadway, New York
Eastern Representative of the Ric-Wil Company

Westinghouse

Motors-and-Control

Work Done

it stands either as a recommendation or condemnation. It is entirely up to you.

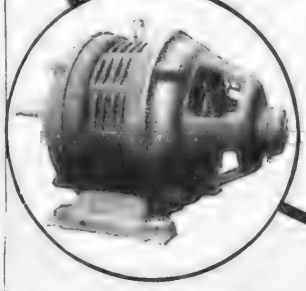
You realize this just as well as we do, that is why we ask you to investigate the merits of Westinghouse Motors and Control for driving ventilating equipment.

Westinghouse Electric & Manufacturing Company manufactures excellent Motors and the proper method of Control for them. Team work is what counts and you secure it with this equipment.

The use of Westinghouse Motors and Control in many of the country's leading public buildings, schools, clubs, stores, and theatres demonstrate their worth.

Trost & Trost, architects for El Paso's magnificent High School, in placing the order for the ventilating equipment with Elliott Engineering Company, specified Westinghouse Motors and Control.

Our engineers will co-operate with you. Send for Booklet 7193.

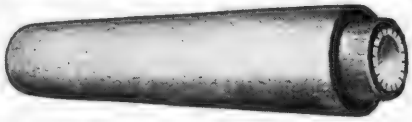


Westinghouse Electric & Manufacturing Company
East Pittsburgh, Pa.

W
WESTINGHOUSE ELECTRIC

EL PASO HIGH SCHOOL.
Trost and Trost, Architects. Elliott Engineering Co. Heating and Ventilating Contractors

STANDARD
Steam Pipe Casing



For Insulating Underground Steam Pipe. Tin Lined, or Unlined.

Every salesman has his argument in order to sell the product he represents. Listen to our argument, be the judge, and you will find same not theoretical but practical, and from actual experience.

When you cover your steam line with our make of casing you have the assurance that the line will be constructed so that no heat will escape, and will be water tight as well, with ample space for air chamber.

Should occasion arise that it is necessary to get at the steam pipe, our covering CAN BE TAKEN APART WITHOUT DESTROYING THE STAVES in the sections of casing, and the same casing can be used again. LET US EXPLAIN HOW.

If your line runs in different branches we will build the casing in exact lengths so that you will not have to cut any sections, which means no waste or extra expense to you.

Our method of building covering will be to your interest. Our product is right, attention prompt, and prices low.

SEND FOR BOOKLET

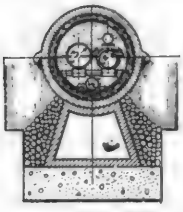
Standard Wood Pipe Co.
WILLIAMSPORT, PA.

MANUFACTURERS OF
Equipment and Supplies
FOR
Central Station Heating Plants

Copper Diaphragm Expansion Joints, Slip Joints, Anchor Crosses, Line Anchors, Collars, Manhole-Curbs, Pipe Guides, and The Detroit Condensation Meter

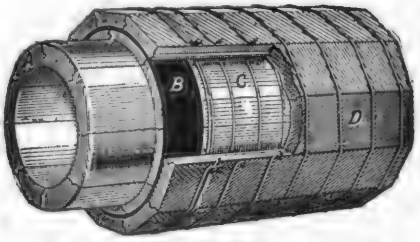
THE DETROIT FEED WATER METER

Central Station Steam Co., Detroit, Mich.



RIC-WIL METHOD
OF
Insulating Underground Steam and Hot Water Pipes
Send for Catalogue

THE RIC-WIL COMPANY
CLEVELAND



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

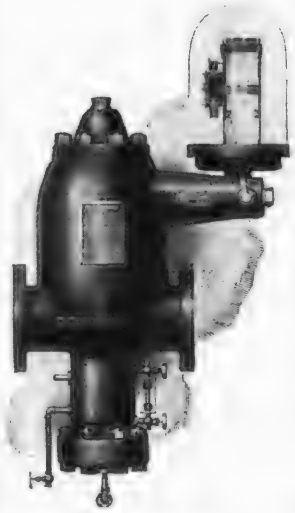
CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

Let us answer your questions and tell you all about it. Booklet on request.

A. WYCKOFF & SON COMPANY
ELMIRA . . N. Y.
Atlanta, Ga.: 378 Piedmont Ave.



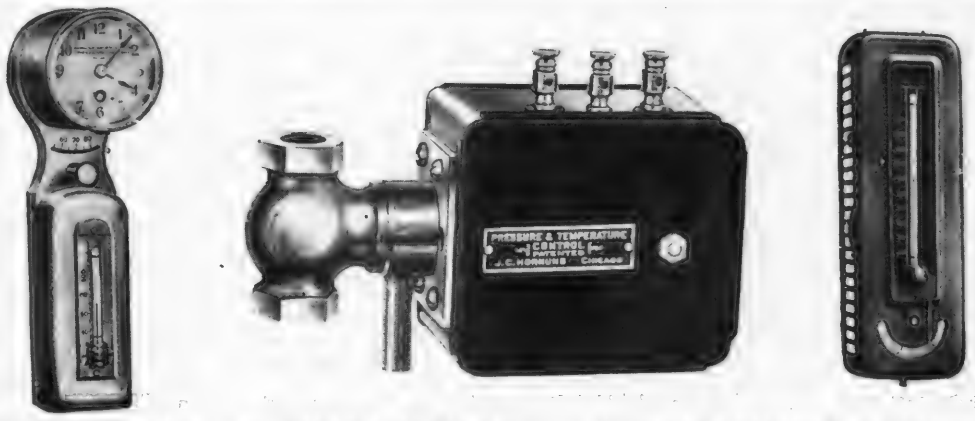
Cut Down Your Coal Bills

Do you know how much steam is being used in your Plant, also how much is used by the different departments? Write today for bulletin No. 146, "The New Straight-Way St. John Steam Meter." It will enable you to "know your costs" for Power, Heating, Cooking, Drying, etc., etc.

AMERICAN DISTRICT STEAM COMPANY

General Offices and Works:
NORTH TONAWANDA, N. Y.

NEW YORK CHICAGO SEATTLE



CONTROL *of* PRESSURES *and* TEMPERATURES *on* CENTRAL HEAT

is the ONLY WAY to compensate for the HIGH COST of production.

The HORNUNG MAGNETIC CONTROL

is designed to meet the above situation and a thousand others.

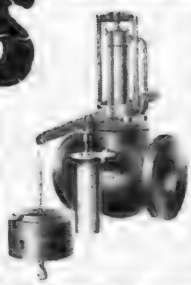
A request for circular, mailed today, will bring good returns

CENTRAL HEAT APPLIANCES

J. C. HORNUNG

343 South Dearborn Street **CHICAGO**

DAVIS



Pressure Regulator

Correct Pressure and Uniform Pressure Insure Efficient Operation

And that means the Davis Pressure Regulator.

It is built like a pair of balance scales. The steam pressure *inside* is balanced by weights on the *outside*—the action is just as visible and accurate as the action of a pair of balance scales. For changing pressure, simply change the weight used.

There is no spring pressure to vary, no packing to interfere with proper action, no delicate parts needing attention and adjustment.

It is as simple and positive in action as the law of gravity—because it *is controlled* by gravity.

That's only one of the Davis steam savers. The others are the Back Pressure Valve for saving the exhaust steam, the Float Valve for maintaining a constant water level, the Stop and Check Valve for preventing return flow, and the Balanced Valve for auxiliary control.

A new valve catalog has just been completed—yes, we're saving a copy for you.

G. M. DAVIS REGULATOR CO.

436 Milwaukee Ave., Chicago

D D

INSTALL THE RADIATOR TRAP

SARCO

AND GET THESE ADVANTAGES

Small—Compact and highly serviceable with lowest possible installation expense.

Send for Literature

Free Trial Offered

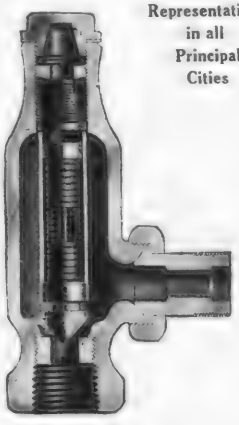
SARCO COMPANY Inc.

Woolworth Bldg.
NEW YORK CITY

Buffalo
Philadelphia

Detroit
Chicago

Representatives in all Principal Cities



EFFICIENCY OF RADIATING SURFACE

The efficiency of radiating surface varies in different types of radiators although not to such an extent as to make any great difference in the amount of surface used. The co-efficients of efficiency are computed by multiplying the condensation (in pounds per sq. ft. per hour) by the latent heat of the steam at its pressure and dividing by the temperature difference between the room and the steam in the radiator. Otherwise the co-efficient may be said to be the number of B. T. U. transmitted per square foot of heating surface per hour per degree difference.

Tests made by Professor R. Allen at the University of Michigan show those co-efficients to be as follows and column 4 is computed from column 3 on the basis of 5 lbs. of steam pressure and 150 degrees temperature difference.

Type of Radiating Surface.	No. of Pounds Condensed per Sq. Ft. per hr.	Co-efficient of Transmission B.T.U. per deg.	Efficiency of Surface B.T.U. per Sq. Ft. Per hr.
CAST-IRON			
1-column	0.212	1.82	273
2-column	0.265	1.65	248
3-column	0.204	1.45	218
6-column	0.217	1.35	202
5 sq. ft. wall (vertical)	—	1.92	288
5 sq. ft. wall (horizontal)	—	2.11	317
7 sq. ft. wall (vertical	—	1.70	255
7 sq. ft. wall (horizontal)	—	1.92	288
9 sq. ft. wall (vertical)	—	1.77	265
9 sq. ft. wall (horizontal)	—	1.98	297
Bare pipe coils			
1 Pipe high	0.410	2.80	420
4 Pipes high	0.425	2.48	372
PRESSED STEEL			
2-column	—	1.53	222

EXAMPLE OF COMPUTING DIRECT RADIATION

Assume a room with three windows and one door with a computed loss of 20,000 B. T. U. Then the direct radiator surface will be 20,000/250 = 80 sq. ft. for either cast-iron radiators or pipe coils on the ceiling.

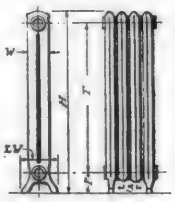
80 + 10% = 88 sq. ft. for cast-iron ceiling radiators.
80 + 20% = 96 sq. ft. for cast-iron recessed radiators.
80 + 40% = 112 sq. ft. for cast-iron concealed radiators.

If ordinary exposed radiators are used they may be divided into four radiators of 20 sq. ft. each—which, however, is rather too small for practical use. Probably three would be used, two of 27 sq. ft. and one—near the door—of 54 sq. ft.

For pipe coils along the walls near the floor the surface would be 20,000/300 = 67 sq. ft.

AMERICAN RADIATOR COMPANY'S ROCOCO ONE-COLUMN RADIATORS FOR STEAM AND WATER

No. of Sections	*Length 2½ in. per Sec.	Heating Surface — Square Feet				
		38-in. Height 3 sq. ft. per Sec.	32-in. Height 2½ sq. ft. per Sec.	26-in. Height 2 sq. ft. per Sec.	23-in. Height 1⅝ sq. ft. per Sec.	20-in. Height 1⅜ sq. ft. per Sec.
2	5	6	5	4	3⅛	3
3	7½	9	7½	6	5	4½
4	10	12	10	8	6⅝	6
5	12½	15	12½	10	8⅓	7½
6	15	18	15	12	10	9
7	17½	21	17½	14	11⅝	10½
8	20	24	20	16	13⅓	12
9	22½	27	22½	18	15	13½
10	25	30	25	20	16⅔	15
11	27½	33	27½	22	18⅓	16½
12	30	36	30	24	20	18
13	32½	39	32½	26	21⅔	19½
14	35	42	35	28	23⅓	21
15	37½	45	37½	30	25	22½
16	40	48	40	32	26⅔	24
17	42½	51	42½	34	28⅓	25½
18	45	54	45	36	30	27
19	47½	57	47½	38	31⅔	28½
20	50	60	50	40	33⅓	30
21	52½	63	52½	42	35	31½
22	55	66	55	44	36⅔	33
23	57½	69	57½	46	38⅓	34½
24	60	72	60	48	40	36
25	62½	75	62½	50	41⅔	37½
26	65	78	65	52	43⅓	39
27	67½	81	67½	54	45	40½
28	70	84	70	56	46⅔	42
29	72½	87	72½	58	48⅓	43½
30	75	90	75	60	50	45
31	77½	93	77½	62	51⅔	46½
32	80	96	80	64	53⅓	48



Connections: WATER—Extra-heavy right and left-hand nipples at top and bottom. STEAM—right threaded, extra-heavy nipples at bottom only.

* Add ½ in. to length for each bushing.

Low-Drip Hubs: ONE PIPE STEAM—on supply leg section; TWO-PIPE STEAM on return leg section.

DIMENSIONS

H = Total overall height.
T = C. to C. of tappings on water radiators.
F = Floor to center of bottom tapping.
W = Width of radiator—4 13/32 in.
LW = Width of radiator legs—5⅜ in.
S = Width of radiator sections; *i.e.*, c. to c. of sections, or 2½ in.

Nominal Height of Radiator	38-in.	32-in.	26-in.	23-in.	20-in.
H	37 5/8	31 47/64	26	23 3/32	20 11/64
T	31 3/32	25 13/64	19 15/32	16 9/16	13 41/64

Note: For legless radiators deduct 3-in. from H.
For high legs add 2-in. and for extra high 4-in. to H and F.

TAPPING DATA

All radiators are tapped 2-in. and bushed as follows:

SYSTEM	Size of Radiator, Square Feet	Supply In. Diam.	Supply F In.	Return In. Diam.	Return F In.
Steam, one-pipe	Up to 24, inc.	1	4	..	..
	24 to 60, inc.	1¼	4	..	..
	60 to 100, inc.	1½	4	..	..
	Over 100	2	4	..	..
Steam, two-pipe	Up to 48, inc.	1	4½	¾	4
	48 to 96, inc.	1¼	4½	1	4
	Over 96	1½	4½	1¼	4
Water	Up to 40, inc.	1	4	1	4
	40 to 72, inc.	1¼	4	1¼	4
	Over 72	1½	4	1½	4

Air valve tappings are ⅛ in.
Vapor tappings, top and bottom, opposite ends, ¾ in. supply and ½ in. return.
All tappings with right-hand threads unless otherwise ordered.

TRADE AND MISCELLANEOUS NOTES

Miscellaneous Notes.

John D. Small, Chicago, Ill., consulting engineer, announces the removal of his offices to Room 1601, 20 East Jackson Boulevard.

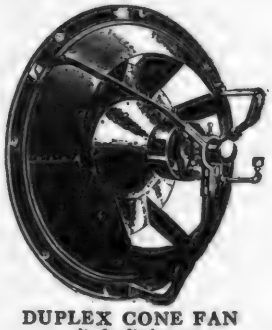
Explosions of boilers in connection with heating plants are reported from Junction City, Kan., and from Princeton, Mo., during the past month. At Junction City the cause was a frozen expansion tank of a hot water heating system in a residence. One fatality resulted. At Princeton the cause was a frozen water pipe connected with the boiler. This was also a residence system. In an effort to increase the heat the boiler was rushed and an extremely high pressure generated. When the boiler let go, water ran down into the firepot, sending a cloud of steam and water into the basement, seriously injuring two persons who were in the basement at the time.

Manufacturers' Notes.

United States Radiator Corporation, Detroit, Mich., has opened a branch office in Indianapolis. J. F. Esperon, for several years with the company's Chicago office, is in charge.

Kellogg-Mackay Co., Chicago, Ill., announces that C. V. Kellogg, president of the company, has acquired the entire interest in this concern. In this connection Mr. Kellogg states that he has sold his interest in the Pierce, Butler & Pierce Mfg. Corporation to eastern business men. It is said that the transaction involved approximately $1,000,000. The Kellogg-Mackay Company will continue to handle the same line of boilers, radiators and heating and plumbing supplies.

Wm. B. Scaife & Sons Co., Pittsburgh, Pa., manufacturers of water tanks, has applied for a Pennsylvana charter, with a capital of $850,000. The company has here-



DUPLEX CONE FAN
Belt Driven

HOWARD & MORSE
45 FULTON ST., N. Y.
Ventilating Engineers and Contractors
MANUFACTURERS OF
BLACKMAN and DUPLEX CONE FANS

which are installed by us complete with **Motors, Duct Work** and **Wiring.**

Aligning, Rigging and **Hoisting** done, with labor thoroughly qualified from long experience.

We make a specialty of **Kitchen Exhaust** work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations.

The **Duplex Cone** Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The **Blackman** Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.

SEND FOR CATALOGUE

BLACKMAN FAN
Direct Connected to Motor

tofore operated under a New Jersey charter. It is stated that no change has been made in the company's personnel or in its products.

Walworth Mfg. Co., Boston, Mass., manufacturers of iron fittings, valves, Stillson wrenches, etc., has elected J. C. Bannister as vice-president of the company. Mr. Bannister has been connected with the manufacture of this type of product for 26 years. He was for three years superintendent of the Kewanee Boiler Company, and when the National Tube Company took over the operation of its Kewanee plant, Mr. Bannister was made manager of the Kewanee works. The Walworth Mfg. Company purchased the Kewanee works in August, 1917, Mr. Bannister will maintain his headquarters in Kewanee for the present.

Central Station Heating Notes.

La Crosse, Wis.—In connection with the application of the Wisconsin-Minnesota Light & Power Company for an increase of 40% in its heating rates, opponents of the increase testified that the company is making profits equal to 16% on its common stock, after paying all capital charges. The commission has the case under consideration.

Muncie, Ind.—The Muncie Electric Light Company has been granted permission to increase its flat rate for steam heating for the remainder of the present season, which ends May 1, 1918, and to eliminate flat rate heating entirely at the end of the season. The new rate is 35 cents per square foot of radiation installed, instead of 25 cents. This new rate is considerably below that proposed by the company, but it is stated the rates will be completely readjusted after next May. At a meeting of the city council, City Attorney John McPhee was instructed to appeal to the Delaware Circuit Court or, if necessary, to file suit, to set aside the commission's ruling on the ground that the commission did not give due consideration to the objections made by the city.

Springfield, Mo.—Increase in steam heating rates asked for by the Springfield Gas & Electric Company will not be granted this winter. It was the ruling of the Missouri Public Service Commission that the present rates cannot be suspended before the expiration of 120 days, or

Control Hot Water This Way

Economy, Safety and Efficiency demand that Water Heaters shall be automatically controlled. The Powers Tank Regulator is a safe and sure controller.

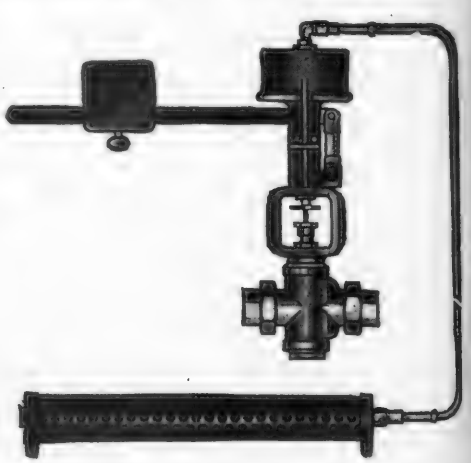
The No. 11 Regulator illustrated is designed especially for Hot Water Tank Heaters.

The "bulb" (A) is inserted through side of tank, into water. Flexible tube (B), any length desired, connects bulb (A) with motor (C) which operates steam valve (D). Motor (C) is set by adjustable spring, to operate at temperature desired.

When water in tank reaches that point, fluid in bulb (A) is vaporized, the pressure being communicated to motor (C) through flexible tube (B) results in closing steam valve (D). When temperature of water falls, the process is reversed, and spring opens steam valve.

The same principle is used in other Powers Regulators for controlling coal or gas-heated tanks.

We have had 30 years of experience in this work. The experience is at your service.



THE POWERS REGULATOR CO.

Specialists in Automatic Heat Control

954 Architects Building, New York
2143 Mallers Building, Chicago
365 The Federal Street Bldg., Boston

Canadian Powers Regulator Co., Ltd., Toronto, Ont.

March 20, 1918. It was stated that failure on the part of the company to comply with the directions of the commission as to proper publication of the proposed changes in rates was the reason for the commission's refusal.

Des Moines, Ia.—According to an announcement made by M. G. Linn, general manager of the Des Moines Electric Co., which was awarded a franchise last March for the construction of a central heating plant in that city, no step towards the construction of the plant will be taken until after the present war. Under the terms of the franchise the plant is scheduled to be completed by October, 1918. Inability to secure material and the commandeering of manufacturing plants by the government are given as the reason for the abandonment of all immediate plans. Thus far no work has been done on the plant.

Luverne, Minn.—The City Heating Company's plant is now complete. The system was installed by Bain & Robb, of Minneapolis, and represents an expenditure of $37,000. Of this amount $21,150 was provided through the sale of stock to business and professional men of the city, all of which is fully paid and non-assessable. The remaining amount is covered by local loans which will eventually be taken up by a bond issue by the company. There are 33 stockholders in the company, controlling 37 business structures which will be supplied with heat from the central plant.

St. Louis, Mo.—An application has been made by the Union Electric Light & Power Co. for permission to readjust its rates for steam heat. At a hearing on the petition it was argued by opponents of the raise that the company has no franchise for conducting a steam heating system and that therefore the commission has no jurisdiction. The commission decided to proceed with the hearing and to pass later on the question of jurisdiction.

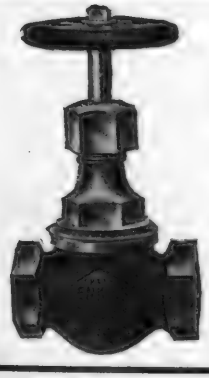
New Incorporations.

Drake Heating & Plumbing Co., Drake, N. D., capital $15,000. Incorporators: E. A. Hohman, John Beutler and William Beutler. **Swetland Heating & Appliance Co.**, Cleveland, O., capital $25,000. Incorporators: W. D. Valentine, T. M. and F. D. Swetland and L. B. Peck.

Contracts Awarded.

Sanitary Plumbing & Heating Co., Sioux Falls, S. D., heating and ventilating Moe Hospital for $30,000; also heating and ventilating Sioux Falls National Bank Building for $40,000; also heating the new cathedral in Sioux Falls for $30,967.

H. G. Newman Plumbing Co., Evansville, Ind., heating and ventilating new junior high school on the West Side for $32,716. The plumbing contract went to the S. A. Schmitt Plumbing Co., at its bid of $18,501.



Jenkins Bros. Valves

are always sold under a guarantee of service and satisfaction. It is less expensive to maintain valves bearing for identification the Diamond Trade Mark, with interchangeable parts throughout, than to have the trouble and expense of replacing valves which have no provision for repairs.

There's a Jenkins Bros. Valve for every purpose. Include them in your specifications.

Jenkins Bros.

New York Boston Philadelphia Chicago Montreal London

STANDARD THERMOMETERS - Indicating and Recording

for VACUUM, STEAM and HOT WATER SYSTEMS, BAKE OVENS and COLD STORAGE PLANTS. SEVEN models of RECORDING and EIGHT of INDICATING Thermometers. All Accurate, Durable and Legible.

Backed by thirty years of Thermometer manufacturing.

They are practically indestructible, are sensitive to changing temperatures and are very easily installed. Supplied with horizontal or vertical extension and standard pipe thread.

Ask for catalog No. 100-107 and trade prices.

STANDARD THERMOMETER COMPANY, 65 Shirley St., Boston, Mass.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write*

Ochempaugh & Chilson, Ames, Ia., heating and plumbing consolidated school building in Strahan, Ia., for $14,309.

Coal Economy and the Heating of Street Cars.

A proposal to allow street cars to go unheated as a war-time economy has aroused the public in several cities. In Burlington, Ia., the city council passed a resolution stating that:

"WHEREAS, Many of the street cars operating within the city are insufficiently heated; be it

"Resolved, That the Street Railway company be requested to maintain and operate the car heating systems so that the public may ride therein in reasonable comfort, or if the present equipment is not sufficient, to install additional heaters."

In Detroit, the board of health, through Dr. Henry M. Vaughan, has expressed the opinion that it would be poor war-time economy to save a little coal at the expense of the health of the general public, claiming that it is detrimental to health for the public to sit or stand for periods of time in unheated cars, without exercise. He said the board of health would prosecute the street railway company for any let-down in the required temperatures for street cars. At present the minimum street car temperature required is 35° F. and the maximum, 65°.

The Vital Spot

in a Blast Heating System

is

AT THE BLOWER

If the Blower is

Ilg Universal

You can be sure that it will be reliable

Motor and Blower

ARE BUILT
BY US and
COVERED BY
ONE GUARANTEE

The one-name plate feature is your protection

ILG ELECTRIC VENTILATING CO.
158 Whiting St., CHICAGO
Branches: All Cities

DETROIT PACKLESS RADIATOR VALVES

The Correct Valve for the Beautiful Home

Detroit Packless Valves are finished with the definite purpose, that they shall harmonize with the most beautiful surroundings. In addition to their unusually pleasing appearance and smooth satin finish they are permanently efficient and will not leak or need repacking.

Booklet VP-1 Gladly Sent Upon Request

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

A census of the manufacture of iron and steel, including the blast furnace, steel-works and rolling-mill, wire and tin-plate and terneplate industries, has been published by the Bureau of the Census Department of Commerce, as a supplement to the Census of Manufacturers: 1914. It is presented under the authorship of Story B. Ladd and was prepared under the supervision of W. M. Steuart, chief statistician for manufactures. Size 9x11½ in. Pp. 68.

New Heating and Ventilating Class at the Bronx Y. M. C. A., New York.

A school of heating and ventilating at the Bronx Y.M.C.A., 161st and Washington

CHICAGO TURBINE VACUUM PUMP

Will Maintain a Vacuum and Return Condensation Directly to Boiler

YOU WILL BE SURPRISED AT ITS SIMPLICITY

Has no gears, pulleys, valves, plungers, intermediate piping connections or complicated separating mechanism.

The entire equipment comes in one Cast-Iron Receiver, all ready for piping and wiring connections. No assembling or complicated piping to do on the job. Illustration shows complete vacuum pump.

WE CAN MAKE A PROMPT DELIVERY

CHICAGO PUMP CO., 900 W. Lake St., Chicago, Ill.

Manufacturers of
BILGE PUMPS, SEWAGE EJECTORS and CONDENSATION, CIRCULATING and HOUSE PUMPS

Johnson { Heat / Humidity } Control

Always the Leader in Inventions and Improvements

First: Practical Heat Regulation.

Second: Pneumatic Thermostats.

Third: Humidostats—the first practical apparatus for the control of humidity.

Fourth: The "SYLPHON" Metal Diaphragm Valve for heat control, the one thing needed to make heat regulating systems durable and reliable. We tested this valve three years before we offered it for use. Untested imitations and substitutes followed fast, but having been thoroughly tested and proven equal to all demands.

the "SYLPHON" is the Recognized Standard.

Fifth: Unequalled Service in all Departments.

Johnson Service Company

Milwaukee, Wis.

Offices in all Large Cities

Avenue, New York, has been inaugurated by Charles A. Fuller, who is the director of the New York School of Heating and Ventilation. The course consists of twelve lectures on Wednesday evenings beginning December 5, 1917. The remaining six lessons for the latter part of January and February will be on piping systems, indirect systems, boiler and boiler plant layout for low-pressure systems, hot blast heating, and ventilation of schools, hotels, churches and theatres.

Annual Report of Bureau of Standards.

Scientific work of unusual volume and interest is described in the annual report of the director of the Bureau of Standards, just issued. Since the war began, all branches of this scientific bureau have been conducting researches on technical problems of military application. The regular work, however, has not been overlooked.

While no investigations have been made bearing directly on heating and ventilation, the work has included the standardization of blood-counting apparatus and other measuring instruments. The regular growth of the bureau and its special expansion on account of the war has resulted in the construction

THESE VALUABLE BOOKS *FREE!*

Each one is worth big money to you. Every heating contractor should have them. They cover all the latest money-making ideas in figuring and installing steam heat—hot water heat—vapor heat—and vacuum systems.

These books will help you to land more orders and increase your profit on every job. Write for them at once. They are absolutely *FREE!*

Moline Illinois

Just a Ball—that's all

OFTEN it's the smallest fitting that kicks up the most trouble. Either it's hard to connect up, or the adjustment is delicate, or some little part keeps wearing out. And, on jobs where your margin is small, these little troubles play hob with profits.

So it will pay you to get acquainted with the Johns-Manville Radiator Valve—because it's the simplest on the market. Just three parts—body, ball, and connecting union; only one moving part—the hollow ball. It regulates itself—no nice adjustments, no chance of tampering. You'll find this valve a money-saver all along the line.

The Johns-Manville Steam Trap operates on exactly the same principle as the Johns-Manville Radiator Trap. Pamphlet and prices on application.

JOHNS-MANVILLE PIPE AND BOILER INSULATIONS: Asbesto-Sponge Felted, 85% Magnesia, Asbestocel, Zero Insulation, Anti-Sweat Insulation, Brine and Ammonia Insulation, Underground Steam Conduit and Insulating Cements.

H. W. JOHNS-MANVILLE CO.
NEW YORK CITY
10 Factories—
Branches in 60 Large Cities

JOHNS-MANVILLE SERVICE
COVERS THE CONTINENT

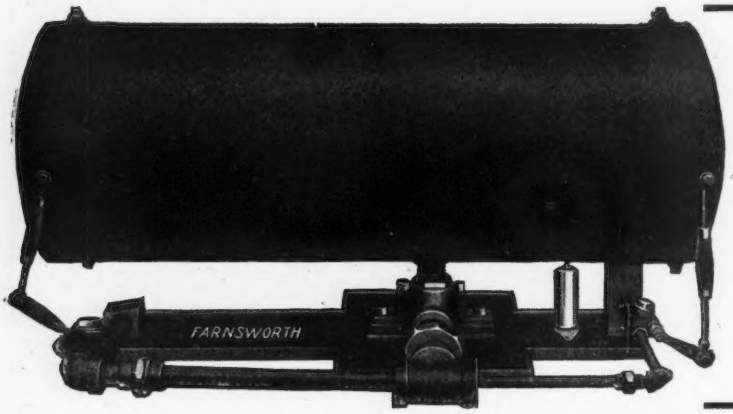
JOHNS-MANVILLE

of several new laboratories and an increase in the staff of about 60%.

The United States Bureau of Mines, Department of the Interior, is sending out copies of the paper on "Preventable Waste of Coal in the United States; with a Consideration of Alternative Methods of its Elimination," by David Moffatt Meyers, as presented at the recent annual meeting of the mechanical engineers' society.

Help Wanted.

Wanted—Large Eastern Manufacturer of engineering specialties long established desires young man, not under 30 years, with technical education, good personality, and initiative; knowledge of heating, ventilation, and power plant engineering and installation practice essential. An excellent opportunity will be provided for development and promotion for the right man. Reply by letter giving full particulars and experience and salary expected. Replies will be treated confidentially. Address Manufacturer, care of Heating and Ventilating Magazine.



Condensation Pumps

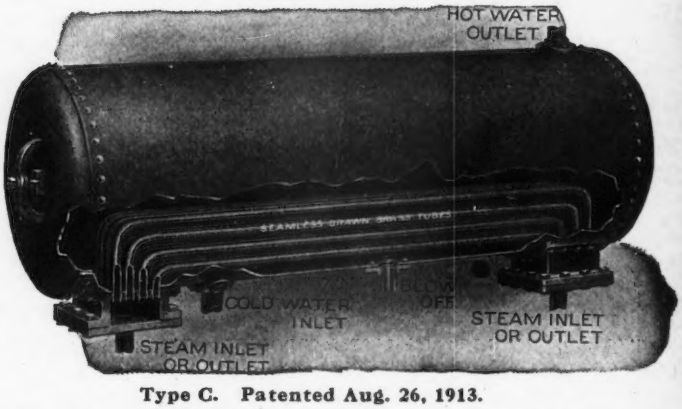
7 Types

Send for catalogue and circular showing systems

FARNSWORTH CO.
Conshohocken, Pa.

THE ⌐¬ SHAPE TUBES EXPLAIN THE SUCCESS
of the
PATTERSON HOT WATER TANK

for heating water for domestic or manufacturing purposes. Both ends of each seamless brass tube are expanded into heavy cast-iron tube-heads with an improved roller expander. Their shape provides for the free contraction and expansion of each individual tube without straining, so there is no danger of leakage.



Type C. Patented Aug. 26, 1913.

Any Combination of Storage and Heating Capacities can be Furnished.
Send for Catalogue.

PATTERSON - KELLEY CO., 23 Dye Street, New York

Representatives in all Principal Cities.